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PHYSICS.

THE MAGNETIC SURVEY OF MISSOURI.

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During the summer of 1878, the writer began a magnetic survey of Missouri. The object to be attained in such a survey is to determine the variation of the needle from due north, the dip of the dipping needle, and the intensity of the magnetic force, at properly selected localities in the State. In field work of this kind, it is not possible to attain the same accuracy that is realized in an observatory, as the mean daily position of the needle varies considerably (two minutes, and often more) from day to day. Hence observations are usually made for five or six days at each station, and the mean value is taken.

Believing that there was something to be learned in regard to local effects, it was our plan to establish a much greater number of stations of observation than is customary, and this made it necessary to spend correspondingly less time at the individual stations. This makes the station values less weighty, *severally*, but, by reason of their greater number, it was thought that the value of the work for general discussion would not be impaired. Hence, as a rule only one or two observations of variation were made at a station unless the result was an unexpected one, or unless we had reason to be dissatisfied with the work.

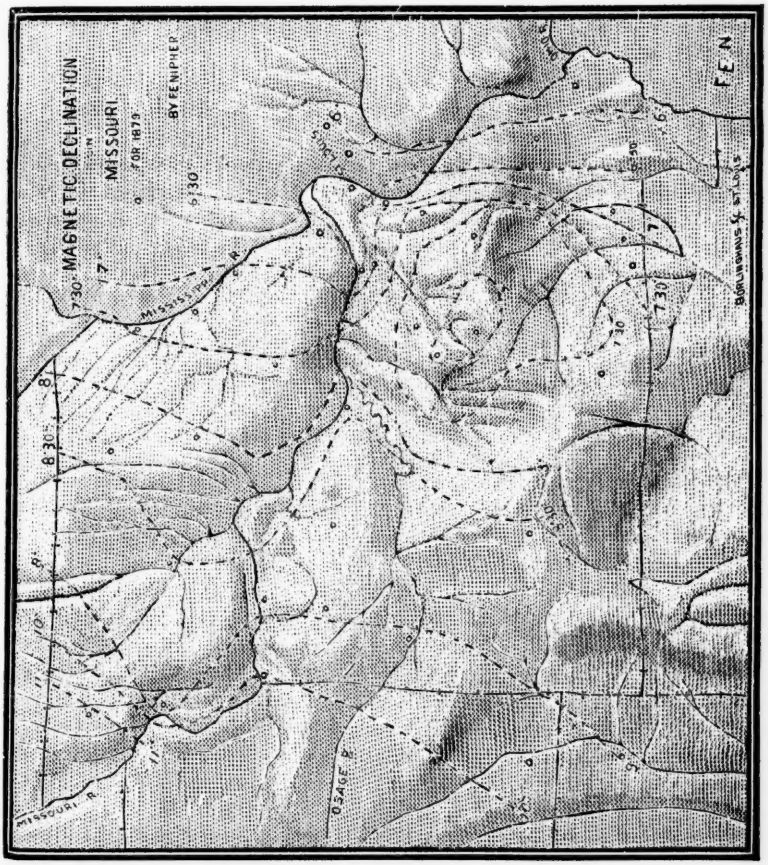
The apparatus used for determination of the variation (or declination) of the needle, consists of a transit of considerable magnifying power and provided with a good horizontal and vertical circle, reading to the half minute. This transit is mounted on a stand which also carries a small box in which the magnetic needle is hung upon a long silk fiber. This needle is of unusual form, being a small

cylinder of steel, bored through from end to end. One end of this cylinder is stopped by a glass plate on which a fine scale is etched. In the other end is put a lens, the principal focus of which is at the scale. This magnet is hung in a stirrup attached to the fiber, in such a way that the scale is viewed through the lens, by means of the telescope. Hence, when the telescope is in focus for a star it will also be in focus for the scale of the magnet.

The observations are made as follows: The verniers of the horizontal scale of the instrument are set on o°, and the telescope is turned on some distant object, as a church spire. This object is taken as the starting point for angles. The lower plate of the transit is then clamped, and the upper one loosened, so that when the telescope is turned, the scale reading of the vernier changes, showing the number of degrees swept over. The telescope is set on the pole star when it is furthest east or west in its path around the pole. It is then only necessary to turn west or east a small angle, (which is given in the astronomical tables) and the instrument will be pointed due north. The vernier reading of due north being thus known, we know the number of degrees between the church spire and north. Hence, on any successive day, we could set the telescope on the spire, and turning this known number of degrees, the instrument would be pointed north. The telescope is then directed upon the magnet scale, and its reading taken. (Call this "A.") After this the magnet is turned upside down, so that the scale is seen inverted. (Call this reading "B.") The scale reading is generally different from the former. If the telescope is turned to the point on the magnet scale, midway between these scale readings "A" and "B," it is found that a reversal of the magnet does not change the reading. The telescope is then directed upon the magnetic axis, and lies in the magnetic meridian, being pointed to *magnetic north*. The angle between this direction and true north, read on the verniers of the horizontal circle, gives the desired variation. It is however well known that the position of the magnetic needle varies during the day, moving over an angle which is seldom less than four or five minutes, and which often amounts to a quarter of a degree or more. Hence, the *mean* position of the magnetic axis is determined for each day.

In order to see the results of such determinations it is customary to record the results reached at each station, at the proper places on a map of the region. Having done this, it is easy to drawn full degree lines through points having the same variation, just as we might draw an *isothermal* line through points having the same temperature. These lines in Missouri were found to be much more irregular than had been supposed, and it was easily seen that there was a marked relation between the contour of the surface and the position of the needle. It appears that the needle tends to set at right angles to river valleys, and that this tendency is inappreciable when the valleys are in general east and west or north and south, and that the tendency is greatest when the valley makes an angle of 45° with these directions. This points to a disturbance in the earth-current sheet, due to unequal conducting power in the moist valleys and on the dry hills. The

matter, however, requires further investigation before it can be regarded as settled.



The woodcut which we present shows the topography of the State in a general way, and the lines of equal variations of the needle are drawn upon it. On the line marked 8°, the needle points everywhere 8° east of north, etc. This cut is after an elegant photograph by the artotype process, which will accompany the third annual report, in the Transactions of the St. Louis Academy of Science. It has also been printed in card form, with descriptive text for more general circulation. The artotype is taken from a plaster cast which was constructed to the scale of 20 miles to the inch, the elevations being exaggerated 200 times. In the photograph and wood cut, the horizontal scale has been changed to 60 miles to the inch.

XUM

The stations of observation are indicated in the cut by the small circles. Four of them have however been inadvertently omitted, viz: Carrollton, which lies on the 8° 30′ line; Glasgow, which is midway between the 8° and the 8° 30′ line; Columbia, which is just east of the 8° line, and Houston, which lies in the westward concavity of the 7° 30′ loop.

Those wishing to secure a larger and more accurate map, with these lines of equal variation upon it, can obtain the fine township map of R. A. Campbell, of St. Louis.

In conclusion it is perhaps proper to add that in the prosecution of this work we have received aid from many public spirited citizens of St. Louis and of the State. It having been found impossible to obtain from the Legislature the small appropriation necessary for finishing the survey, it is now at a stand. It is hardly reasonable to ask private citizens to carry on work which is clearly a matter for public enterprise.

THE KANSAS CITY ELECTRIC TIME BALL.

BY PROF. H. S. PRITCHETT, MORRISON OBSERVATORY.

The first time ball established in the United States was dropped from the dome of the Naval Observatory at Washington in 1855. It is still dropped at Washington mean noon, and has for a long time furnished the standard time for the city and the Departments of the Government. The apparatus employed and the method of dropping the ball are extremely simple. At five minutes before noon the ball is raised to the top of the staff on the old dome of the Observatory. The signal which drops it is made by hand by an assistant stationed in front of the mean time clock in the Observatory below. The ball when released drops upon the dome and thence rolls to the roof beneath.

The New York time ball, established in 1877, is dropped at New York noon by an electric signal, sent from the Naval Observatory at Washington. It was erected and is maintained by the Western Union Telegraph Company, and is dropped from their building on Broadway. At 11h. 55m. the ball it hoisted half-way up the staff on the tower of the building. At 11h. 58m. it is hoisted to its highest point, when it is about 250 feet above the street and can be well seen by the shipping at the New York and Brooklyn docks, and vessels in the bay and from suitable positions, is visible to a large part of the citizens of New York, Brooklyn, Hoboken and Jersey City.

The ball is 3ft. 6in. in diameter. It is really not a sphere but consists of circular pieces of metal joined together in such a way as to present the appearance of a solid ball when viewed from any direction.

If on account of wind the ball fails to drop at 12h. om. os., it is held till 12h. 5m. and then dropped. In such cases a small red flag is hoisted at 12h. 1m. and kept flying till 12h. 10m. This ball was for some time dropped by hand, but for

the last year the dropping has been automatically effected by the clock at the Observatory. The working of the apparatus has been in the main satisfactory, and the ball has been dropped quite regularly, the failures being caused almost entirely by temporary breaks in the wire or other causes which could not be foreseen.

In the evening papers of the day and in the papers of the next morning a notice is regularly inserted, stating whether the ball dropped at correct time, and if not, its error, fast or slow. Many are at a loss to know how this correction is obtained. It is arrived at in the following manner: The time of the falling of the ball records itself automatically by electricity, near the standard clock of the Western Union Company in the building, the clock itself being regulated by the daily clock-signals from Washington. The difference between the time of falling of the ball and noon, as indicated by the clock, is thus obtained by a direct comparison. This assumes of course the accuracy of the clock and during a long continued season of cloudy weather, or in case of accident to the clock itself, the time might be somewhat in error, although the published correction might show but a few hundreths of a second. At present however, the Western Union has the benefit also of the Alleghany and Cambridge signals, for the regulation of this clock, so that even during the longest season of cloudy weather it is not probable that the clock could be much in error.

The Boston time ball, which is dropped at noon of Boston time, by means of the noon-time signal from the standard clock of the Harvard College Observatory, is placed upon the large building of the Equitable Life Assurance Company and was paid for and is now maintained by this company. The ball is of copper and weighs about 250 pounds. The machinery used in raising and controlling it is hence much more complicated and costly than in either of the cases before mentioned. The cost of ball and machinery was about $1200. The electric signal which drops it, is given by the clock itself, the ball having a drop of fifteen feet. The nearness of the Observatory, and the fact that the wire used is wholly under its control, give additional convenience and certainty in the dropping of this ball, and reduces the probability of accidents to a minimum, so that it is effected with great regularity and precision. Prof. Pickering, Director of the Observatory, reports that for the year ending Nov. 1st 1880, the ball was dropped exactly at noon on 355 days; on four other days at five minutes past noon, in accordance with the rule adopted; on four other days it was not dropped, leaving only three cases of inaccuracy of dropping.

Quite recently a time ball has been established at Hartford, Conn., and dropped by the Winchester Observatory of Yale College.

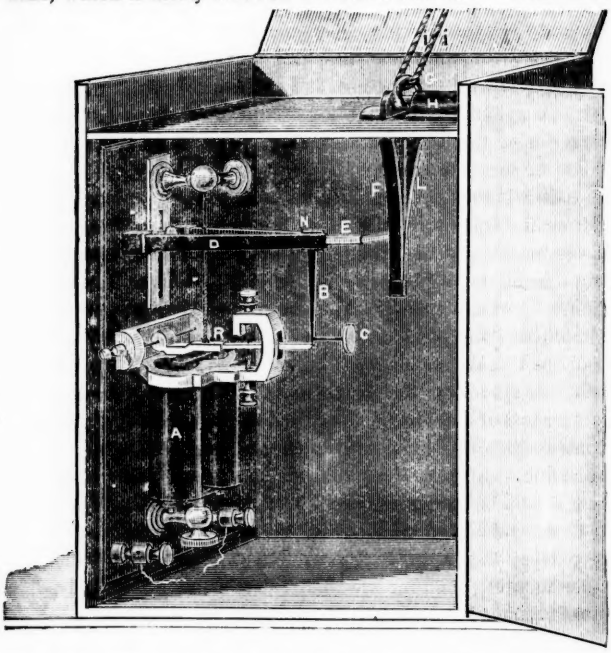
The time ball recently erected at Kansas City, and which is dropped as a part of the time service of the Morrison Observatory, is the first attempt in this direction in the west. It was paid for chiefly by an appropriation of the City Council of that city. The site selected was the large building just erected by the Messrs. Bullene, Moores & Emery, on Delaware street. The ball when raised to the top of the staff is about 140 feet above the street, and is generally visible to the busi-

ness portion of the city. The ball which passes over the staff, is simply a wire skeleton covered with canvas and painted black, and is about three feet in diameter. It was loaded on the inside with lead until it was found to drop instantly and without loss of time. It has a drop of about twenty five feet and is slowed up as it reaches the bottom, and is received upon a set of tall springs surmounted by a stout cushion.

The apparatus used in dropping it is shown in the accompanying cut.

It is the arrangement of Mr. William F. Gardner, the skillful instrument maker at the Naval Observatory, who probably has had a wider experience in the construction of such apparatus than any one else in this country.

The machinery is simple and easily understood from the figure and answers every purpose. It is mounted in a box about two feet high and fifteen inches wide, which is firmly screwed to a table beneath. The cut shows it as it stands ready for dropping the ball, which is drawn up to the top of the staff 5 minutes before noon.



The ropes (ii) which hold the ball in place are shown in the figure passing through a ring (G). The bolt which holds this ring is a continuation of the perpendicular piece (L). This is being constantly pressed back toward the right by a strong spring concealed under (H), and is only kept from flying back by the small arm (B), which fits into a notch on the end of (E). (A) in turn is kept from flying out to the left by the armature (R) of the magnet (A). As soon now as the circuit is closed at the Observatory at noon, this armature is instantly pulled down, the piece (B) flies out to the left, the ring is released and the ball drops. This has been found to work easily and without loss of time and can scarcely get out of order. The entire cost of mounting the ball and machinery was only about $120, and with this

small amount it was necessary to use the utmost economy in the purchase of materials and apparatus. The apparatus thus briefly described, has been found to answer every purpose, and is probably as accurate as very much more costly apparatus would have been. Kansas City is about one hundred miles from the Observatory and except in cases of breaking of the wire, when the ball cannot be dropped at all, it is dropped within one or two-tenths of a second of correct time.

The discrepancy in the local time kept by different jewelers in the city, before the erection of the ball was astonishing, and led to endless confusion in business and travel.

On the first day the ball dropped this difference in extreme cases amounted to fifteen or twenty minutes, some being eight or ten minutes fast others as slow. The establishment of the time ball has brought about a uniformity never before known, and must soon make itself felt not only as a convenience, but a promoter of punctuality in business engagements.

From the daily clock-signals sent over the wires from the Observatory it will be easy to establish a similar time signal in any city in the west, which will take the necessary steps to procure these signals. An arrangement has been made also by which they may be distributed to jewelers, and clock-makers, and manufacturing establishments in the larger cities.

The people at Kansas City are indebted to the officers of the Western Union Telegraph Company, for many courtesies in connection with the establishment and maintenance of this time ball. Mr. W. K. Morly, Supt. of Telegraph on the Chicago & Alton Railroad, kindly allows the use of a wire in dropping the ball, while at Kansas City Mr. M. D. Wood, Superintendent, and Mr. W. H. Woodring, chief operator, have gratuitously given their services each day at the time when the ball is dropped. Without their cordial cooperation, the success attained would have been impossible.

DESTRUCTION OF FORESTS.

T. L. LEWIS, BOLIVAR, MO.

The indifference of our people to forestry is criminal. It has been estimated that there are but six states east of the Rocky Mountains which have a surplus of timber; yet, nearly all are denuding their lands and shipping wood, ties and lumber. Strike a line through Minnesota, Iowa, Kansas, and Texas; or take longitude 80° west of Washington, and the eastern side contains all the timber, while the western is almost one boundless desert of treeless prairie. California is far above an average, yet only about one-twentieth part is timbered. This western world of prairie is now teeming with active life, and must soon be the home of millions, with their shops, factories, railroads, etc., etc. It becomes then a practical question—will the supply meet the demands under our present reckless system of the wanton destruction of our forest? It is an impossibility unless the

timbered states legislate wisely on this matter, and the prairie states follow the example of Kansas in the cultivation of forests. Let us look at a few facts.

It has been estimated that 30,000,000 of our people use wood as fuel, consuming 100,000,000 cords annually. We have about 90,000 miles of railroads consuming 400,000 acres of timber every year. Steamboats, factories, brick yards, etc., consume annually about 35,000,000 cords. And more than 70,000 factories of wood articles also consume about $410,000,000 of timber every year. The total forest cutting annually is estimated at nearly one thousand millions of dollars. Again we ask, at this enormous and wholesale rate of forest destruction, can the supply meet the demands of the rising west and still provide for the wants of the east, unless our forests are protected by law?

HISTORICAL NOTES.

THE SPANISH EXPEDITION TO MISSOURI IN 1719.

JOHN P. JONES, KEYTESVILLE, MO.

The Memoirs, Historical Journals, and other writings in which the French have narrated the events that occured during their occupation of the vast territory which they called Louisiana, contained frequent mention of an expedition which left Santa Fe, N. M., about the year 1719 for the purpose of establishing a military post in the upper Mississippi Valley as a barrier to the further encroachments of the French in that direction. One of the objects aimed at by the Spanish authorities in sending out this expedition is said to have been the destruction of the tribe of Indians known as the Missouris, who were supposed to be especially under the influence of the French; intending by the destruction of this nation to intimidate those of the surrounding localities and make them more inclined to ally themselves with the Spaniards than with the French. The account of this expedition most generally accounted as correct during the last century, is the one given in Dumont's Historic Memoirs of Louisiana.* Dumont was one of a party ascending the Arkansas river in search of a supposed mass of emeralds, and says: "There was more than half a league to traverse to gain the other bank of the river, and our people were no sooner arrived than they found there a party of Missouris, sent to M. de la Harpe† by M. de Bienville§ then Com-

*Memoires Historiques sur La Louisiana, 2 Vols., Paris, 1753. The author was a Lieutenant in the French army and lived twenty-two years in the colony. His work has never been translated, though French in his Historical Collections of Louisiana prints a portion of one volume, and Du Pratz, in his work makes large drafts on both.

† Bernard de la Harpe, a French officer who was very active under Bienville during the first years of the colony. In 1719 he built a fort on Red River. In 1720 surveyed a portion of the coast of Texas and took possession of the country near the Bay of St. Bernard. He received a concession of lands on the Arkansas. At the date mentioned by Dumont he was the leader of an expedition sent to explore the Arkansas River. He wrote a work called "Historical Journal of the Establishment of the French in Louisiana," which remained in manuscript until the year 1831, when it was printed in French.

§ The second governor of Louisiana and the "Father of the Colony." His career is a matter of history.

mandant General at Louisiana, to deliver orders to the former. Consequently they gave the signal ordered and our other two canoes having crossed the river. the savages gave to our commandant the letters of M. de Bienville, in which he informed him that the Spaniards had sent out a detachment from New Mexico to go to the Missouris and to establish a post in that country. In the same packet there was a map drawn by a Spanish geographer, of the route which the caravan have held from Santa Fe, and there we noticed a large lake which they had crossed and to which they gave the name of Red Sea. I have scarcely a doubt that this is the lake which M. de Lisle ‡ calls in his map the Sea of the West. The success of this expedition was very calamitous to the Spaniards. Their caravan was composed of fifteen hundred people, men, women and soldiers, having with them a Jacobin for a chaplain, and bringing with them a great number of horses and cattle, according to the custom of this nation to forget nothing that might be necessary for a settlement. Their design was to destroy the Missouris, and to seize upon their country, and with this intention they had resolved to go first to the Osages, a neighboring nation, enemies of the Missouris, to form an alliance with them and to engage them in theit behalf for the execution of their plan. But, perhaps the map which guided them was not correct, or they had not exactly followed it; it chanced that instead of going to the Osages whom they sought, they fell, without knowing it, in a village of the Missouris, where the Spanish commander, presenting himself to the great chief to offer him the calumet, made him understand through his interpreter, believing he was speaking to the Osage chief, that they were enemies of the Missouris, that they come to destroy them, to make their women and children slaves and to take possession of their country; consequently he begged that they would be willing to form an alliance with them, against a nation whom they regarded as their enemy, and to second them in this enterprise, promising to recompense them liberally for the service rendered, and to be always their friend in the future. Upon this discourse the Missouri chief understood perfectly the mistakes. He dissimulated and thanked the Spaniards for the confidence they had in his nation; he consented to form an alliance with them against the Missouris and to join them with all his forces to destroy them, but he represented that his people were not armed and that they dare not expose themselves without arms in such an enterprise. Deceived by so favorable a reception, the Spaniards fell into the trap laid for them; they received with ceremony, in the little camp they had formed on their arrival, the calumet which the great chief of the Missouris presented to the Spanish commander. The alliance war sworn to by both parties, they agreed upon a day for the execution of the plan which they meditated, and the Spaniards furnished the savages with all the munitions which they thought were needed. After this ceremony both parties gave themselves up equally to joy and good cheer. At the end of three days two thousand savages were armed and in the midst of dances and amusements, each nation thought of nothing but the execution of his design.

‡ William de Lisle, an officer of the French army whose maps of Louisiana were very correct for the time of their publication.

It was the evening before their departure upon their concerted expedition, and the Spaniards had retired to their camps as usual when the great chief of the Missouris, having assembled his warriors, declared to them his intentions and exhorted them to deal treacherously with these strangers, who were come to their home only with the design of destroying them. At daybreak the savages divided into several bands, fell on the Spaniards, who expected nothing of the kind, and in less than a quarter of an hour all the caravan were murdered. No one escaped from the massacre except the chaplain, whom the barbarians saved because of his dress: at the same time they took possession of all the merchandise and other effects which they found in their camp. The Spaniards had brought with them as I have said a certain number of horses, and as the savages were ignorant of the use made of these animals, they took pleasure in making the Jacobin whom they had saved and who had become their slave, mount them. The priest gave them this amusement almost every day for the five or six months that he remained in their village, without any of them daring to imitate him. Tired at last of his slavery and regarding the lack of daring in these barbarians as a means that Providence had offered him to regain his liberty, he made secret all the provisions possible for him to make and which he believed necessary to his plan. At last having chosen the best horse and having mounted him, after having performed several of his exploits before the savages, while they were all occupied with his maneuvers, he spurred up and disappeared from their sight, taking the road to Mexico, where doubtless he arrived. Sometime after a party of these same Missouris went to the Illinois with the intention of presenting the calumet to the French general who was in command at that place"

"It was the Sieur de Boisbriant* who in the visit these savages made him, was not a little surprised to see some of them covered with sarcerdotal vestments, others wearing stoles and some others wearing a chalice cover hanging on their neck, or a chalice in their hands. After informing himself on the subject of this masquerade he ransomed from the savages the sarcerdotal habiliments, profaned by these barbarians. It was from them that he had the map of which I have spoken, which they found among the possessions of the Spaniards. He gave it immediately to the general in command of the country, with all the details of this adventure, and it was from the latter that we learn the particulars which I have just related."

It is difficult to say how much of the foregoing is truth and how much romance; nearly every writer of French annals of Louisiana gave credence to the story in almost the precise form given by Dumont. Several English compilers also adopted it and it seems to have been generally received as the truth. M. Bossu † in his book on Louisiana follows the story about as we have given it,

* Pierce Duque Boisbriant, a cousin of Bienville, who arrived in the colony in 1699, was a major and knight of the Blue Ribbon. Was for a long period in command at Biloxi and led several expeditions against the neighboring Indian tribes. Left Mobile in October 1718 for the Illinois country where he had been appointed as commandant of the post In 1721 he received the cross of St. Louis, and in 1724 was appointed governor *ad interim*, Bienville being suspended. In 1726, on the downfall of the Bienville regime, he sailed for France.

† Travels through that part of North America called Louisiana, by M. Bossu, captain in the French Marine. 2 Vols., London 1771.

but adds additional particulars in regard to the visit of the Missouris to the French commandant at the Illinois, describing the procession as they marched and danced, with the ornaments of the chapel suspended about their necks, and that of a horse they had brought with them.

Du Pratz § in his history of Louisiana, gives a condensed account of the expedition similar to the foregoing and adds, speaking of the visit of the Missouris to the Illinois, "They had brought the map which had so disastrously led the Spaniards. After having having examined it, it appears to me better suited for the west of our colony toward them than for the country in which we are interested. From this map it would seem that we should bend the Red and Arkansas rivers as I have said in its place, and place the source of the Missouri more to the west than our geographers do."

Dumont, as I have shown, also writes of the same map and the fact that the expedition had with them the map of the country, would seem to give weight to the belief entertained by the French at the time, that the enterprise was undertaken by the Spaniards, with a purpose which agreed in general with the story of their intentions as told by the Missouris.

Charlevoix,* who traveled from Quebec to New Orleans in the year 1721, says in one of his letters to the Duchess of Lesdiguieres, dated at Kaskaskia, July 21, 1721: "About two years ago some Spaniards, who came, as they say, from New Mexico, intending to get into the country of the Illinois and drive the French from thence, whom they saw with extreme jealousy approach so near the Missouri, came down the river and attacked two villages of the Octotas,‡ who are allies of the Ayouez,† and from whom it is also said they are derived. As the savages had no fire-arms and were surprised, the Spaniards made an easy conquest and killed a great many of them. A third village, which was not far off from the other two, being informed of what had passed and not doubting but these conquerors would attack them, laid an ambush into which the Spanirds heedlessly fell. Others say that the savages having heard that the enemy were almost all drunk and fast asleep, fell upon them in the night. However it was, it is certain the greatest part of them were killed. There were in the party two almoners; one of them was killed directly and the other got away to the Missourites, who took him prisoner, but he escaped from them very dextrously. He had a very fine horse and the Missourites took pleasure in seeing him ride it, which he did very skillfully. He took advantage of their curiosity to get out of their hands. One day as he was prancing and exercising his horse before them, he got a little distance from them insensibly; then suddenly clapping spurs to his horse he was soon out of sight."

Charlevoix also says that he obtained the spur of the Almoner that was killed and that the Indians had his breviary. The story of the priest and the manner

§ History of Louisiana, Etc., by M. Le Page, Du Pratz Paris 1758. The author was for many years a government factor in the Province of Louisiana, and on his return to France published the above work.

*The celebrated Jesuit father, author of "The History of New France.' Journal of a Voyage to N. A. Leters to the Duchess, etc.

‡Otoes. †Iowas.

of his escape seem to be nearly as well authenticated as that of the map. Charlevoix writes from near the place where the expedition met its fate and within two years of the time it left Santa Fe, and the probabilities are that he was at the Illinois when the Missouris came over and told the commandant their story. Besides the spur and breviary, he mentions that one Indian had a pot of ointment which he prized very highly. It will be seen that he locates the scene of disaster to the Spaniards as among the Otoes. This tribe were of the same family as the Missouris and spoke nearly the same language; seventy-five years later, when the Missouris were nearly destroyed by tribes from the north, the remnant found shelter and home with the Otoes and finally became merged in this tribe. It is possible that the Spaniards did attack the two villages of Otoes, and that they fled down the river to their allies, the Missouris, who ambushed the Spaniards and destroyed them.

De la Harpe, in his Historical Journal of the Establishment of the French in Louisiana, says, under the date of April 24, 1721: "M. de Bois Briant writes from the Illinois that the Spaniards, to the number of 300 men, were come out from Santa Fe, capital of New Mexico, with the design of taking possession of the lands of this colony. Of these 300 men only 70 had put the enterprise in execution and passed through several savage nations, guided by the Padoucas, who, instead of leading them east quarter northeast, went too far to the north, so that they arrived on the banks of the Cances* river near the Missouri; there they had met the nations Octotata and Passinaha,† who had killed all of them except one friar, who had been saved on his horse."

It will be observed that the author just quoted gives the report of the commandant at the Illinois, and that he fixes the number comprising the expedition at 70 men. This I believe to be much nearer the truth than the number stated by Dumont. Such an expedition could be easily destroyed by any of the tribes on the Missouri river at that time.

Stoddard,‡ in his Historical Sketches of Louisiana, writing of the expedition, says it was intended to make allies of the Pawnees and obtain their assistance in destroying the Missouris, and on this point observes: "Various writers assert that these colonists aimed to find the Osage villages, but the records of Santa Fé authorize the statement we have given." If such records were in existence when Mr. Stoddard wrote, they are not to be found now, as I have had them searched for diligently. The extracts I have cited give in substance what the early French historians and annalists wrote concerning the expedition, and while it must be admitted they vary, still there is sufficient evidence for us to believe that the Spaniards at Santa Fé fitted out and dispatched a body of men, with instructions to lay the foundation of what was hoped would be an obstacle to the spread of French dominion west of the Mississippi. That this expedition was destroyed

*Kansas.

†Pana of Marquette; Panys of Perot; Panis of Charlevoix; Panismahas of the Jesuit letters, and Pawnees of the present time.

‡Sketches Historical and Descriptive of Louisiana. By Major Amos Stoddard. Philadelphia, 1812. The author was the first governor of the colony of Upper Louisiana after the cession of Louisiana to the U. S.

by the Indians, is also probable, and the locality where it met its fate should be an object of interest to the investigators of our early history. If destroyed by the Otoes and Pawnees, it is probable that the destruction took place not much west of Kansas City; if by the Missouris, it was not far from the mouth of Grand River, as the old village of the Missouris was but a few miles east of where that river empties into the Missouri, and the counties of Howard and Chariton are prolific in Indian remains. At the date of this expedition the French were reaching out toward the Spanish possessions in a manner calculated to excite the jealousy of the latter nation. De la Harpe, under the authority of Gov. Bienville, had built a fort and formed a settlement on Red River, and, in correspondence with the Spanish commandant at Assinais, had laid claim on behalf of the French to the province of Texas, basing his claim on the fort built by La Salle in 1685. Dumont, another French officer, was exploring the Arkansas, whose waters extended nearly to Santa Fe, while the French at the Illinois post were considering the possibility of a route to the Pacific Ocean by way of the Missouri. In attempting to confine the French to the east bank of the Mississippi, the Spaniards were but trying to guard a territory which they believed to be rightfully their own, and which, in the year 1762, was relinquished to them by the French.

THE MOQUIS.

In the history of the aboriginal races of this country, little is said regarding the Moquis, a branch of the Pueblos, living, where possibly they have lived for a thousand years, in a rocky stronghold in a sandy desert of Arizona. This people number about two thousand five hundred, and occupy six villages, with houses built of stone, cemented with sand and clay. These villages, says Dr. Loew, of Wheeler's surveying expedition, are built on the tops of four sandstone mesas, which are separated from each other about eight miles. They occupy the entire width of the mesas, and, standing immediately before the houses, one may look vertically down a depth of three hundred feet. In many places the sides of the mesas are terraced, being used as sheep corrals. In appearance the Moquis come rather nearer to the Caucasian than the rest of his race. These Indians are well clad, and the females especially so. Indian corn is the principal food—the sheep are raised for their wool rather than for the table. From the wool a good blanket is made. The seed corn is planted about one and a half feet from the surface, at which depth sufficient moisture is found to develop and sustain the plant. The Moquis have neither church or any other place of worship, and the Spanish Jesuits were unable to gain a foothold among them.

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GEOLOGY AND PALÆONTOLOGY.

THE JUDITH RIVER GROUP.

BY CHAS. H. STERNBERG.

[*Read in part before the Kansas Academy of Science.*]

The upper Missouri cuts its way for hundreds of miles through the great shale beds of the Fort Pierre group: they contain quantities of the salts of soda and magnesia, and all the waters flowing through them are strongly impregnated with these salts. On the top of this group lie the soft buff-colored sandstone of Cretaceous No. 5., or Fox Hills group. So far as I have examined, they are destitute of fossils. Near the mouth of the Judith river and for one hundred and fifty miles down the Missouri, the summits of the surrounding hills are covered with the rocks of Cretaceous No. 6, or the Judith river group. They consist of an upper and lower stratum of brown sandstone, interlaid with beds of various colored clays, fresh water *unios* and Lignites. These beds were first discovered and described by Dr. Hayden, to whose untiring energy we are indebted for our knowledge of the stratagraphy and geology of the Northwest. He was driven out of the country by Blackfeet Indians, and was only able to save some teeth and turtle shells. These have been described by Dr. Leidy, as follows:

Triodon formosus, and *Amblysodon horridus*, Carnivorous Dinosaurs and *Paleocincus costatus*, and *Trachodon mirabilis*. Herbivorous Dinosaurs of the *Testudinata* are *Trionyx foveatus*, *Compsemys vetus*, and *Emys obscurus*. These specimens were prophetic of a rich store in wait for the fortunate explorer who would be able to make a collection in this interesting country and carry it away.

Ever since Hayden's explorations this country has been looked to with interest by scientific men. In 1876 Prof. Cope resolved to go to the Juidth river, and he thought he could do so safely, as the Sioux were south fighting the soldiers. I joined the Professor at Omaha, in August. At Ogden we took the Northern Utah Railroad for Franklin, Idaho, where a journey by stage of 600 miles awaited us. Through Idaho the alkaline dust drove in great clouds, and nearly blinded us: we hailed the mountains with delight. Only persons who have made long journeys by stage can know of the discomforts we endured. We outfitted at Fort Bentons the head of navigation on the Missouri. Our party consisted of five men. One to act as guide, one as cook, the other three including Prof. Cope, were collectors. We traveled down the Missouri one hundred and twenty miles to the Judith River and went into camp at Dog Creek where our field work began.

The beds of the Judith River group lay on the summits of hills or in synclinal valleys near the top. Our first work every morning was to climb to the summits of the Bad Lands, about 1500 feet, over beds of black shale. At first

we only discovered loose bones, teeth and turtle shells. We had hard work clinging to the almost perpendicular bluffs, where a misstep would hurl us into a cañon 1500 feet deep. We had often to cut niches for our feet with hand picks, which we always carried, as without them we would have been unable to travel. The surface was covered with loose angular fragments of cherty rock, that rolled under our feet. One great hardship we had to endure, was the lack of drinking water during the day, as all that was found in the Bad Lands was strongly impregnated with alkaline salts. Another hardship was the presence of great swarms of small gnats that got under our hat rims, and inflicted wounds that poisoned the flesh. But our toils were well rewarded, as we were able to add some forty new species of strange animal life to science; and I think that of all the singular and unique animals that have peopled our earth, some that we discovered were the strangest. They were great land saurians or *Dinosaurs*. They were the most numerous of the animal remains we collected. Some of them reached to the enormous height of twenty-eight feet. They walked on their hind limbs, which were strong and pillar-like. An immense tail helped support their ponderous weight while feeding on the tender branches and leaves of trees. Their front limbs were short and armed with powerful claws for grasping. In each jaw were three rows of teeth, and below each old tooth was a hollow groove containing five young ones. As fast as one row wore out another took its place. We found thousands of these cast-off crowns. Of course I have been speaking of the Herbivorous or plant eaters. The Carnivorous *Dinosaurs* were lighter and more elegantly built for springing on the huge plant eaters. They were armed with a single row in each jaw, of long re-curved teeth, with serrate edges. Young teeth were ready to take the place of old ones, when they were broken or worn out.

The *Dinosaurs* resembles the bird in many parts of its structure. They have but one occipital condyle. Their bones are light and hollow. They also resemble the mammals by their habits, and the structure of the pelvis and pectoral arches. But on account of many reptilian characters, they are classed in that division of vertebrate life. Turtles were abundant, and were usually soft-shelled, and other fresh water species. The shells were often curiously marked with elevated or depressed lines, or punctures. Among the fishes *Ganoid*, or the *Lepidosteus*, that ancient and persistent type, were common. One peculiar species I discovered of the shark family, had six-sided teeth, with a line down the long diameter, with dark-colored enamel on one side and light on the other. They were arranged in the roof and floor of the mouth, like bricks in a pavement, and were used as a mill for grinding up shells. Prof. Cope calls it *Myledaphus bipartita. Batrachia* were abundant. No mammals were found, though a number of geologists have thought these beds to be of Tertiary age. The explorations of Prof. Cope, have, I trust, proved conclusively that they are Cretaceous. The upper beds are covered in places with oyster shells, showing that at the close of the Cretaceous the sea covered the formation. Large deposits of lignite are found both in this and the Fort Pierre group. There are also great quantities of fossil wood scattered through the formation.

Near Cow Island, six miles down the Missouri, we found three nearly perfect skeletons, the femur of one specimen being five feet in length. While we were camped on Dog creek Prof. Cope went ahead to Cow Island, and sent word for us to follow with outfit. This was no easy job, as we had to get our wagon to the top of the Bad Lands over the steep slides of the Ft. Pierre group. We had made a bridle path to the summit, and following this we made the venture. After unloading the wagon it took four horses to haul it within about four hundred feet of the summit. Here the slides were very steep and the bridle path led along the side. Our teamster refused to drive any further so Mr. Isaac took his place, after taking off the lead horses. I went ahead on horse-back to encourage the team, but before we had gone ten yards the horses' feet slipped from under them, and taking the wagon with them, they made three complete summersaults and landed on their feet all right, with the wagon in its proper position. The reader can easily imagine the peals of laughter that greeted this exploit. Our next performance met with more success. We took the horses to the top of the hill and tied our picket ropes together, and fastened one end to the hind axle, the other to the doubletrees, and the team hauled our wagon safe and sound to level ground, though all hands had to hold down on the upper sills of the wagon box to prevent another overturning.

When we reached the uplands a magnificent view burst upon us. To the south lay the Judith river and Medicine Bow Mountains, while to the north were the Little Rockies and Bear Paw Mountains, and far below us the waters of the great Missouri looked like a silver thread. We found ourselves on a broad, level prairie, covered with bunch grass, while at the heads of ravines that ran into the Missouri were groves of pines. The country for miles had been dug up by grizzly bears in search of artichokes. We often crossed heavy elk and deer trails. At the head of Dog creek we saw a number of buffaloes and deer; the country seems to be full of game, and is the favorite hunting grounds of the Crow and Sioux Indians.

When we reached Cow island we proposed to go into camp on the Missouri; the only place where it was possible to get down the bluffs with a wagon was very steep. However, it is easier to get down a steep place than up it. A kick sent our rolls of blankets on their way, and a couple of ropes tied to the hind axle and held by a half-hitch around a tree, kept everything steady. A man at the tongue guided our wagon until it reached level ground, of course the ropes were let out as the wagon descended by its own weight. Night had overtaken us when we reached our camping ground, which we found covered with cactus. They were dug away from a place large enough for our tent and fire. My first thought on awaking the next morning, after examining our camping ground, was, How in the world will we ever get out of this place? We were in a small valley containing five or six acres, the bluffs extended on either side to the river, and behind us was the place we had let the wagon down, and I knew that unless it was taken to pieces and packed on horses, it never could be taken up the way it came down. But

as the Professor assured me he would find a way out, I was satisfied, as I had a great deal of faith in his ability to accomplish almost anything.

We were camped three miles below Cow island, and when we were ready to move, the Professor purchased an old scow, on which we loaded our outfit, swam our horses over and paddled across. Then as the shore was low on that side, we turned it into a tow-path, hitching a horse to our scow, and after a great deal of labor we found ourselves at the boat landing of Cow island. The next day Prof. Cope took the steamer for Bismarck and Mr. Isaac and myself were left to complete the explorations; we remained until November, when hearing that the Indians were returning, and as cold weather had set in, we returned to Fort Benton, after a disagreeable joueney on account of snow. We saw great droves of antelope, deer and some buffalo. I suffered a good deal on my return trip by stage, but after the troubles were over and I was safe within the bounds of civilization, I could but congratulate myself with the feeling that I had helped advance the interests of Science. The discomforts of the explorer are soon forgotten in the results accomplished. I will give my readers a partial list of the species discovered, to show the results of the expedition. All are new except those already described, and have been described by Prof. Cope in Bulletin of U. S. Survey.

REPTILIA.

DINOSAURIA.

Gonipoda.
Triodon formosus.
Lælaps cristatus.
L. falculus.
L. lavifrons.
L. hazenianus.
L. incrassatus.
Amblysodon horridus.
A. lateralis.
Zapsolis abradeus.

PROCÆLIA.

Paronychodon lacustris.

ORTHOPODA.

Paleocincus costatus.
Dysganus peiganus.
D. bicarinatus.
D. haydenianus.
Dichocrinus pentagonus.
D. perangulatus.
D. calamarius.
Trachodon mirabilis.
Monoclinus crassus.

CROCODILIA.

Crocodilus humilis. (*Leidy.*)

TESTUDINATA.

CRYPODIRA.

Trionyx foveatus.
T vagans.
T, mammilaris.
Plastomenus punctulatus.
Polythorax missouriensis.
Compsemys victus.

ELASMOBRANCHII. (L. L.)

Myledaphus bipartita.
Hedronchus sternbergii.

GEOLOGICAL CLIMATES.

4 ADDISON GARDENS,
KENSINGTON, 11th February, 1881.

EDITOR REVIEW:—I venture to send you a number of *Nature*, with a letter of mine, which I have thought it necessary to write after the perusal of a controversy that has been carried on for some weeks past, between two distinguished men, namely, Mr. Wallace, author of the Malay Archipelago, and Island Life, etc., and the Rev'd Samuel Haughton, Professor of Geology in the University of Dublin, on "Geological Climates," the former maintaining that were there certain depressions, or rather submergences of portions of land, tropical currents would flow Northward through the openings, thaw all the Polar ice, and make the Arctic climate almost if not wholly temperate.

Prof. Haughton takes quite an opposite view, and thinks the ice-cap at or near the Pole may be hundreds of feet thick, and that the Arctic current flowing South would interfere materially with the heating influence of the tropical stream.

So much is required to explain the meaning of my letter, which, from fearing it would occupy too much space, I did not make so explanatory as I could have wished. Yours Truly, JOHN RAE.

"I have read with much interest and attention the letters that have appeared in recent numbers of *Nature* on the subject of "geological climates," and although it must appear presumptuous on my part to do so, I shall endeavor to show that each of the distinguished writers of these letters may be somewhat in error on at least one point, which—if I am right— must materially affect the correctness of the conclusions they have come to.

I think that Mr. Wallace, whilst very justly giving the Gulf Stream and other currents, which *might* exist were certain lands submerged, credit for great influence in ameliorating the rigor of climate, does not take into sufficient consideration the fact that the waters of the Gulf Stream, although warmer, are, in consequence of holding much more salt in solution, heavier than the colder and less saline Arctic current.

Some experiments show, as clearly as anything done on a very small scale can, that two waters brought as nearly as possible to the conditions of the Gulf Stream and the Arctic current do not mingle when simultaneously poured into a long narrow glass trough; the Arctic water invariably taking its place on the surface.

Supposing then that these two currents meet somewhere about latitude 80° or 81° N., the Arctic water flowing south—if my experiments are of any value—will retain its position on the surface and the warm current pass underneath, and thus lose all its heat and influence on the air over a Polar area about 1000 geographical miles or more in diameter.

We can have no stronger example of this effect of difference of density of ocean water than is shown by the two currents *in* and *out* of the Mediterranean Sea.

In *Nature*, vol. xxiii. p, 242, Prof. Haughton says, "The thickness of this ideal ice-cap at the Pole is unknown, but, from what we know of the Palæocrystic ice of Banks Land and Grinnel Land, *must be measured by hundreds of feet, and its mean temperature must be at least 20° F. below the freezing point of water.*"

With regard to both the above assumptions—which are in italics—I must beg to disagree entirely with the learned Professor. He appears to consider the so-called Palæocrystic ice as the normal state of the ice at and near the Pole, and as a natural growth by the gradual freezings or increase of a single floe during a series of years; whereas I am of opinion that this mis-called Palæocrystic ice is the result of a number of floes being forced over and under each other by immense pressure caused by gales of wind and currents.

The western and northern shores of Banks and Grinnel Lands are peculiarly well suited for the formation of such ice heaps; as they are exposed to the full force of the prevailing north and northwest storms, which pile up the ice in a wonderful manner on these shores and others similarly placed, for a distance of miles seaward. The whole of the west shore of Melville Peninsula is so lined with rough ice of this kind that sledging is impossible.

It will wholly depend upon the form of land—if any—at or near the Pole, whether or not any floebergs are there. If there is no land it is probable there will be few or none, as the ice will meet with no great obstruction, as it is driven by winds and currents.

I have no authorities by me that give the thickness of ice formed in one season at or near the winter quarters of any of the Arctic expeditions, except my own in 1853-4 at Repulse Bay, latitude 66° 32′ north.

The measurements of the ice—taken at some distance out in the bay, where there was very little snow—and the mean temperature of the air are given.

1853	Ice thickness	Increase	Monthly Mean Temp. F.
December 20	...4 feet 7 inches...	—	...24°·5 below zero
1854			
January 24	...5 feet 9 inches	...14 in 35 days	...30°·6 " "
February 25	...7 feet ¾ "	...16 in 32 days	...34°·9 " "
April 25	...8 ft 1½ "	...12¾ in 59 days	... 8°·5 " "
May 25	...8 ft 1¼ "	...none 30 days	...24° above zero

The above table shows that the ice ceased to increase in thickness some time between April 25 and May 25. after which it decreased rapidly; but I was unable to decide what proportion of this decrease was due to thaw and evaporation from the surface, and what amount from the lower part of the floe that was under water; no doubt by far the greater effect was produced by the first two causes.

Eight feet may perhaps be considered a fair or rather a high average of one winter's formation of new ice (not increase of an old floe) over the whole of the Arctic Sea; because Repulse Bay, although in a comparatively low latitude, was particularly favorable for ice-formation, there being no currents of any consequence. Where there are currents, one year's ice does not exceed three or four feet.

The winter's ice of 1875-6 at Discovery Bay, in latitude 81° 40′ N., did not

exceed, if I remember correctly, six feet in thickness.

Even were these great compound floes, called Palæocrystic ice, found at or near the Pole, and of only the same thickness as those seen at Grinnel Land—instead of "hundreds of feet"—they would not probably have nearly so low an average temperature all the year round as 20° F. below the freezing point of water, because only one-sixth of their mass would be exposed to very low temperature for about six months of the year, the surface being during that time protected by a more or less thick covering of snow, whilst at least five-sixths of their bulk was under water, having a temperature for the whole twelve months of or about the freezing point of the sea. The question is, how far the very low temperature of an Arctic winter penetrates a mass of, say sixty feet of ice, the surface of which is covered with a foot of snow, and fifty feet or five-sixths under water of a temperature at or above the freezing point of the sea?

From my experience on a much smaller scale, I do not believe that the atmospheric cold would, under the circumstances mentioned, penetrate to the lower surface of ice sixty feet thick; and if it does not do so there would be no increase to its thickness during the winter.

An excellent example of formation of Palæocrystic ice, or floe-berg is afforded by the experience of the Austro-Hungarian Expedition under Weyprecht and Payer in the Barentz Sea in 1873-4. Their ship was lifted high out of the water by the pressure of the floes, which were forced over and under each other to a great thickness and extent in a few days.

The ship and her crew were helplessly drifted about for many months, during which the floes were frozen together into one solid mass, and the inequalities of the surface in a great measure filled up with snow-drift. JOHN RAE.

4 Addison Gardens, January 29.

GEOGRAPHICAL NOTES.

HEATH'S DISCOVERIES IN SOUTH AMERICA.

PROF. JOHN D. PARKER, KANSAS CITY, MO.

Since the death of Prof. Orton in South America, his assistant, Dr. Ivon D. Heath, and his brother, Dr. E. R. Heath, have both taken a deep interest in completing the unfinished work of that expedition. Prof. Orton had formed the purpose of conducting his expedition through the unexplored portion of the Beni river, over which there has always hung such an uncertainty and superstitious fear. But just before he reached this portion of his journey, the soldiers, whom he had hired and paid in advance for his whole expedition, intimidated by superstitious fear, suddenly presented their bayonets at the breast of Prof. Orton, refused to go any further and returned home. Prof. Orton was, therefore, com-

pelled to abandon his expedition, and returned almost heart-broken to die of weariness and disappointment on the legendary lake of Titicaca.

About three years ago, Dr. E. R. Heath returned to South America to complete, if possible, Prof. Orton's work, and explore this unknown region, the *terra incognita* of South America. It was hoped that some Geographical Society would aid in this important work, but while plans were being laid to secure material assistance, Dr. E. R. Heath undertook and solved the problem himself.

On December 28, 1880, Dr. Heath, of Wyandotte, Kansas, received a letter hastily written by his brother, dated Reyes, Bolivia, on the river Beni, Aug. 3, 1880, on the day of his embarkation for the rubber camps and the unknown country further below. He wrote that he was just setting out to explore this unknown region, and that three months would tell the tale of his success or defeat.

On March 19th, Dr. Ivon D. Heath received another letter from his brother in South America, announcing that his expedition had proved a complete success. The following extract will be interesting from this letter, which is dated Reyes, Bolivia, Dec. 20, 1880:

"The question of the Beni is solved. This work of Professor Orton is finished. I made the trip from Cabinas (rubber camps on the Madidi) in a canoe with two Indians. I left Cabinas September 27, and, after delays from sickness of my men, at 8 A. M., October 8th, discovered a new river entering from the south, and at mid-day of the 8th arrived at the junction of the Madre de Dios with the Beni. No other white man has ever seen the mouth of this magnificent river. Crude measurements gave 735 feet for the width of the Beni, and 2350 for that of the Madre de Dios. Took careful observations for latitude and longitude. At 6:50 A. M. of the 9th, I passed the mouth of a river the size of the Yacuma, entering from the north, to which I gave the name Orton.

At night we slept on a sand-bar joined to a large island. On the 10th we passed this island, and at 8 A. M. another large one, and at 10 A. M. came to a line of rocks obstructing the river and making rapids. One mile further down we came to the main fall, which exhibits a perpendicular descent of the entire river of thirty feet. We occupied the remainder of the 10th in drawing our little craft over the rocks to the waters below. With much risk we passed the waves below the falls and camped. On the morning of October 11 we passed some rocks in the river corresponding to the rapids of the Palo Grande of the River Mamoré, but which, here, offer no serious obstructions to navigation. At 10 A. M., October 11, 1880, we arrived at the mouth of the Beni—that is, at the junction of the Beni and Mamoré rivers. From thence we ascended the Mamoré, 300 miles, to Exaltacion and Santa Ana, and from Santa Ana to this place, 200 miles west over the pampas; brought my boat on an ox cart.

Here I am safe and sound with a map of the three rivers—Beni, Mamoré and Yacuma. From the river Madidi to the mouth of the Beni there are but four families of Pacavara Indians in the place of "multitudes of man-eating savages," as every man, woman and child in Bolivia has believed during many scores of years. Rubber gatherers are already taking advantage of my exploration, and have established camps further down the Beni."

On account of superstitious fear of the unexplored portion of the river Beni, the productions of the rubber camps on the river Madidi have ascended the river Beni, 200 miles to Reyes, thence east 200 miles to river Mamoré, thence 300

miles north to its union with the Beni—700 miles around, in place of less than 300 miles direct. The waters of the Beni come down from the gold mines of Bolivia and through forests of Cinchona trees; and the Madre de Dios from a much larger area of similar territory of Peru.

Dr. Heath, alone, unaided, spent two years in patient, determined preparation near the scene of the proposed exploration, and then, in a frail canoe, with only two Indian servants, with certain death before them, as all Bolivia believed, paddled bravely forth to explore a great river and extensive country where, during 350 years, a score of costly expeditions have disastrously failed. It is thought that the governments of Peru and Bolivia will give official recognition of his daring and successful achievement. His work will develop and change the commerce of many hundred miles of mountain and plain. Rubber and bark will now descend the Beni, instead of going 600 or 700 miles around. What risk and danger he faced in descending an absolutely unknown river, larger than the Mississippi, in which were rapids and falls! What satisfaction he must have felt when his canoe entered the yellow waters of the Mamoré, having successfully braved the superstition of ages and opened up a new country to commerce!

Dr. Heath has achieved a noble work in exploring this unknown region, which will be recognized everywhere, and as long as the Orton river flows, men will remember the explorer whose name it bears, who contributed so much to our knowledge of South America, and gave up his life to the cause of science.

CONGRESSIONAL APPROPRIATIONS FOR SCIENTIFIC PURPOSES.

[The following extracts from the bill making appropriations for sundry civil expenses of the government for the fiscal year ending June 30th, 1882, will be of interest to our readers and to scientists generally:—EDITOR.]

THE HOWGATE POLAR EXPEDITION.—Observation and exploration in the Arctic Seas: For continuing the work of scientific observation and exploration on or near the shores of Lady Franklin Bay, and for transportation of men and supplies to said location and return, twenty-five thousand dollars.

Lieut. A. W. Greely, 5th U. S. Cavalry and Acting Signal Officer, has been assigned by the Secretary of War, to the command of this expedition. Lieut. Greely will be permitted to select such officers and men from the army as will be required to carry out the objects of the expedition. In our next issue we shall probably be able to give fuller details of the *personnel* of the expeditionary force.

THE BENNETT POLAR EXPEDITION.—To enable the Secretary of the Navy to immediately charter or purchase, equip, and supply a vessel for the prosecution of a search for the steamer Jeannette of the Arctic Exploring Expedition (which the Secretary of the Navy is hereby authorized to undertake), and such other vessels as may be found to need assistance during said cruise, one hundred and seventy-five thousand dollars: Provided, That said vessel shall be wholly manned by volunteers from the Navy.

On March 15th the Navy Department paid $100,000 for the whaling steamer Mary and Helen, to be sent in search of the Jeanette.

GEOLOGICAL SURVEY.—For the expenses of the Geological Survey, and the classification of the public lands and examination of the geological structure, mineral resources, and products of the national domain, to be expended under the direction of the Secretary of the Interior, including pay of civilian employees, one hundred and fifty thousand dollars.

The unexpected balance for the completion of the office work of the Geological and Geographical Survey of the Territories for the fiscal year, eighteen hundred and eighty-one, was also re-appropriated and made available for the same purposes.

MISSISSIPPI RIVER COMMISSION.—For salaries and traveling expenses of Commission, office expenses, and reduction of work; for continuation of surveys and gaugings of Mississippi River and its tributaries; for permanent gauge-stations and borings; for publication of maps and results, one hundred and fifty thousand dollars.

NORTH AMERICAN ETHNOLOGY.—For the purpose of continuing ethnological researches among the North American Indians, under the direction of the Secretary of the Smithsonian Institution, twenty-five thousand dollars; five thousand dollars of which shall be expended in continuing archæological investigations relating to Mound-builders and prehistoric mounds.

SMITHSONIAN INSTITUTION.—For the expense of exchanging literary and scientific productions with all nations by the Smithsonian Institution, three thousand dollars.

Preservation of collections, Smithsonian Institution: For preservation and care of the collections of the surveying and exploring expeditions of the government, fifty-five thousand dollars.

Preservation of collections, Smithsonian Institution, Armory building: For expense of watching, care and storage of duplicate government collections, and of property of the United States Fish Commission, Two thousand five hundred dollars.

UNDER THE COMMISSIONER OF FISH AND FISHERIES.—Propagation of food-fishes: For the introduction of shad and fresh-water herring into the waters of the Pacific, the Atlantic, the Gulf and Great Lake States, and of salmon, white-fish, carp, gourami, and other useful food-fishes into the waters of the United States generally, to which they are best adapted; also for the propagation of cod, herring, mackerel, halibut, Spanish mackerel, and other sea fishes, and for continuing the inquiry into the causes of the decrease of food-fishes of the United States, ninety-five thousand dollars, which shall be immediately available.

COAST AND GEODETIC SURVEY.—Survey of the Atlantic and Gulf coasts, eastern division: For every purpose and object necessary for, and incident to, the continuation of the survey of the Atlantic and Gulf coasts of the United States, the Mississippi and other rivers, to the head of either tidal influence or

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ship navigation; soundings, deep-sea temperatures, dredgings, and current-observations along the above-named coasts, in the Gulf of Mexico, and the Gulf Stream, including its entrance into the Gulf, its course through the Carribbean and into and around the Sargasso Sea; the triangulation toward the western coast, and furnishing points for State surveys; the preparation and publication of charts, the Coast Pilot, magnetic map of Eastern North America, and other results of the work, with the purchase of materials therefor, including compensation of civilians engaged in the work, three hundred thousand dollars.

For continuation of the resurvey of the Delaware Bay and river, ten thousand dollars.

Survey of the Pacific coasts, western division: For every purpose and object necessary for, and incident to, the continuation of the survey of the Pacific coasts of the United States, the Columbia and other rivers, to the head of either tidal influence or of ship-navigation; deep-sea soundings, temperatures, currents, and dredgings along and also in the Japan Stream, flowing off these coasts; the triangulation toward the eastern coast, and furnishing points for State surveys, the preparation and publication of charts, the Coast Pilot, the magnetic map of Western North America, and other results of the work, with the purchase of materials therefor, including compensation of civilians employed in the work, one hundred and eighty thousand dollars.

SIGNAL SERVICE.—Observation and report of storms: For the expenses of the observation and report of storms by telegraph and signal for the benefit of commerce and agriculture throughout the United States; for manufacture, purchase, and repair of meteorological and other necessary instruments; for telegraphing reports; for expenses of storm-signals announcing the probable approach and force of storms; for continuing the establishment and connection of stations at life-saving stations and light-houses; for instrument-shelters; for hire, furniture, and expenses of offices maintained for public use in cities and ports receiving reports; for river reports; for maps and bulletins to be displayed in chambers of commerce and boards of trade rooms, and for distribution; for *original studies*, books, periodicals, newspapers, and stationery; and for incidental expenses not otherwise provided for, three hundred and seventy-five thousand dollars.

SIBERIAN COMMERCE.

A document has been issued by the German Foreign Office describing the various attempts made during the past three years to reach the mouths of the Siberian river by way of the North Cape. In 1878, seven vessels undertook the voyage to the Artic Sea; two steamers arrived in Orbi, four in the Yenisei, and the seventh, a sailing vessel in the Lena, up which river it sailed to Jakustok, a distance of 2700 versts. The greater number of these vessels returned to Europe in the same season with return freights.

The attempts made in the two following years were less successful. Of seven ships which left in 1879 only one was able to accomplish the voyage around the North Cape. In 1880 five ships penetrated into the sea of Kara. The two German steamers, the *Lutse* and the *Dahlmann*, bound for the Yenisei river, forced to return. The *Dahlmann* encountered to the northward of Novayo Zemlya, a sea of ice as impenetrable as that which it had met with in the south side of the island. The ship *Nordland*, freighted by the well known Russian Merchant Siberiakoff, twice entered the Sea of Kara but its progress was also stopped by heavy masses of ice and had to return to Europe. This failure did not discourage the enterprising merchant, for in July, 1880, he himself started for the North in the steamer *Oscar Dickson*, charted in Gothenburg and provisioned for ten months. He left Vardö in August, arrived in Jugor Strait before the end of the month, but the whole month of September was spent in vain attempts to cross the Kara Sea. Later in the year the ship was seen by the captain of the steamer *Neptune* in the Matotskin Schar, sailing up and down to the ea tward of Novayo Zemlya, and once returning through that strait to the western side of the island. For some time no farther news was received of the whereabouts of the *Dickson*, excepting a rumor that she was frozen in at the mouth of the Yenesei. In consequence of this rumor Siberakoff's brother sent an overland expedition to the mouth of that river. Subsequently news was received of the *Dickson's* safe arrival at Tobolsk.

Only the fifth ship, the *Neptune*, already mentioned, reached the mouth of the Orbi and returned in the same season to Europe laden with grain. The condition of navigation in the Kara Sea as shown by the experience of the last three years, have disappointed the hopes of a productive and profitable commerce hitherto entertained, but it is possible that further experience and observations will remove many of the obstacles that were encountered.

For this purpose observing stations are about to be established at the mouth of the Lena and Kolyma, or upon one of the New Siberian Islands. Lieut. Türgens has been assigned to the direction of the station on the Lena.

METEOROLOGICAL STATIONS IN BEHRINGS SEA.

The Signal Service, in coöperation with the Smithsonian Institution, the N. W. Trading Co., the Western Fur and Trading Co., and the Alaska Commercial Co., proposes to establish an extensive system of stations during the present year, for the purpose of making an exhaustive study of the meteorological and other natural phenomena of the exterme northwest coast of the American continent, and of the islands in Behrings Sea.

The stations named below have been partially decided upon for occupation. The Latitude and Longitude given are approximative only:

STATIONS.	LATITUDE.	LONGITUDE.
Copper Island	54° 30′	192° 00′
Attu Island	53° 00′	187° 00′
Atka Island	52° 30′	174° 30′
Unalaslika Island	53° 00′	166° 00′
St. Paul Island	57° 30′	170° 00′
St. Michaels	63° 30′	162° 00′
Point Barrow	71° 30′	156° 30′
Nuchagakak.	61° 00′	162° 00′
Sitka	57° 00′	135° 30′
Cordova Bay	54° 45′	132° 20′
Portage Bay	59° 00′	135° 30′
Yakutat	59° 30′	140° 00′
Fort Yukon	66° 30′	145° 00′
Fort Renai	61° 00′	151° 00′
Port Etches	60° 30′	147° 00′
Kuskokvim	61° 00′	161° 30′

And eleven other stations not yet selected. It is expected that Russia will establish a coöperating station at Petropadlovsk in about Latitude 53° and Longitude 201°.

The station at Point Barrow is part of the American quota of the International chain of Polar Stations.

The Meteorological Office of Canada, under the energetic supervision of Mr. Carpuxael, proposes to establish a full station on Melville Island, at Winter Harber, in Lat. 74° 45′; Long. 111°, provided the necessary Government assistance can be obtained. The proposed site is where Parry wintered in 1819–20, and is an admirable location for one of the International chain of stations.

ASTRONOMY.

PLANETARY PHENOMENA FOR APRIL, 1881.

BY W. W. ALEXANDER, KANSAS CITY, MO.

Mercury on the 7th reaches its greatest elongation west, but owing to its position being so much south of the sun, it cannot be observed well from Kansas City.

Venus on the 11th reaches the stationary point in its orbit, *i. e.*, its position among the fixed stars will remain unchanged for a short time. This apparent rest in its motion is caused by our being in the direction in which it is moving; after this it will continue rapidly to approach the sun, being so near to that orb after the 25th as to escape observation except with the telescope.

Mars during this month will be among the stars in Aquarius.

Jupiter and Saturn have approached so near the sun's place that a good view of them cannot be obtained this month. On the 22d they are in conjunction with each other and also with the sun.

Uranus is situated in the constellation Leo about 12° east and 4° south of Regulus, the brightest star of that constellation. It is now in a very favorable position for observation, and as only a few persons have ever seen this planet the present opportunity should not be missed. It shines with the light of a 6th magnitude star, and under the most favorable circumstances is visible to the naked eye.

Neptune is situated in the constellation Aries, but being so faint, owing to its enormous distance, cannot be seen except with good astronomical instruments.

The Moon on the 1st is in conjunction with Venus, passing south of that planet 3° 22′. On the 10th it is within 6° 19′ of Uranus. By the 28th it will be again in conjunction with Venus, passing south 2° 40′, but both will be so near the sun that they cannot be seen with the unaided eye.

DELICATE SCIENTIFIC INSTRUMENTS, AND SOME RECENT RESULTS OF THEIR USE.

BY EDGAR L. LARKIN, NEW WINDSOR OBSERVATORY, NEW WINDSOR, ILLINOIS.

Within the last five years, scientific men have surpassed previous efforts in close measurement and refined analysis. By means of instruments of exceeding delicacy, processes in nature hitherto unknown, are made palpable to sense. Heat is found in ice, light in seeming darkness, and sound in apparent silence. It seems that physicists and chemists have almost if not quite reached the ultimate atoms of matter. The mechanism must be sensitive, as such properties of matter as heat, light, electricity, magnetism and actinism, are to be handled, caused to vanish and reappear, analyzed and measured. With such instruments, nature is scrutinized, revealing new properties, strange motions, vibrations and undulations. Throughout the visible universe, the faintest pulsations of atoms are detected, and countless millions of infinitely small waves, bearing light, heat and sound are discovered and their lengths determined. Refined spectroscopic analysis of light is now made, so that when any material burns, no matter what its distance, its spectrum tells what substance is burning. When any luminous body appears, it can be told whether it is approaching or receding, or whether it shines by its own or reflected light; whence it is seen that rays falling on earth from a flight of a hundred years, are as sounding lines dropped in the appalling depths of space. We wish to describe a few of these intricate instruments, and mention several far-reaching discoveries made by their use; beginning with mechanism for the manipulation of light. Optics is based on the accidental discovery that a piece of glass of certain shape will draw light to a focus, forming an image of any object at that point. The next step was in learning that this image can be viewed

with a microscope, and magnified; thus came the telescope revealing unheard of suns and galaxies. The first telescopes colored everything looked at, but by a hundred years of mathematical research, the proper curvature of objectives formed of two glasses was discovered, so that now we have perfect instruments. Great results followed; one can now peer into the profound solitudes of space, bringing to view millions of stars, requiring light 5,000 years to traverse their awful distance, and behold suns wheeling around suns, and thousands of nebulæ, or agglomerations of stars so distant as to send us confused light, appearing like faint gauze-like structures in measureless voids. The modern telescope has astonishing power, thus: When Mr. Clark finished the great 26-inch Equatorial, now at Washington, he tested its seeing properties. A photographic calligraph whose letters were so fine as to require a microscope to see them, was placed at a distance of three hundred feet. Mr. Clark turned the great eye upon the invisible thing and read the writing with ease. But a greater feat than this was accomplished by the same instrument—the discovery of the two little moons of Mars, by Prof. Asaph Hall, in 1877. They are so small as to be incapable of measurement by ordinary means, but with an ingenious photometer devised by Prof. Pickering of Harvard College, he determined the outer satellite to be six, and the inner seven miles in diameter. The discovery of these minute bodies seems past belief, and will appear more so, when it is told that the task is equal to that of viewing a luminous ball two inches in diameter suspended above Boston, by the telescope situated in the city of New York. [Newcomb and Holden's Astronomy, p. 338.

Phobos, the nearest moon, is only 4,000 miles from the surface of Mars, and is obliged to move with such great velocity to prevent falling, that it actually makes a circuit about its primary in only 7 hours 38 minutes. But Mars turns on *its* axis in 24 hours 37 minutes, so the moon goes round three times, while Mars does once, hence it rises in the west and sets in the east, making one day of Mars equal three of its months. This moon changes every two hours, passing all phases in a single Martial night; is anomalous in the solar system, and tends to subvert that theory of cosmic evolution wherein a rotating gaseous sun cast off concentric rings, afterward becoming planets. Astronomers were not satisfied with the telescope; true, they beheld the phenomena of the solar system; planets rotating on axes, and satellites revolving about them. They saw sunspots, faculæ and solar upheaval; watched eclipses, transits, and the alternations of summer and winter on Mars, and detected the laws of gravity and motion in the system to which the earth belongs. They then devised the Micrometer. This is a complex mechanism placed in the focus of a telescope, and by its use any object, providing it shows a disc, no matter what its distance, can be measured. It consists of spider webs set within a graduated metallic circle, the webs movable by screws, and the whole instrument capable of rotating about the collimation axis of the telescope. The screw head is a circle ruled to degrees and minutes, and turns in front of a fixed vernier in the field of a reading microscope. One turn of the screw moves the web a certain number of seconds; then as there are

360° in a circle, 1-360th of a turn moves the web 1-360th of the amount, and so on. Thus, when two stars are seen in the field, one web is moved by the screw until the fixed line and the movable one are parallel, each bisecting a star. By reading with the microscope, the number of degrees turned the distance apart of the stars becomes known; the distance being learned, position is then sought; the observance of which led to one of the greatest discoveries ever made by man. The permanent line of the micrometer is placed in the line joining the north and south poles of the heavens, and brought across one of the stars; the movable web is then rotated until it bisects the other, and then the angle between the webs is recorded. Double stars are thus measured, first in distance, and second, their position. After this, if any movement of the stars takes place, the tell tale micrometer at once detects it.

In 1780, Sir Wm. Herschel measured double stars and made catalogues with distances and positions. Within twenty years, he startled intellectual man with the statement that many of the fixed stars actually move—one great sun revolving around another, and both rotating about their common center of gravity. If we look at a double star with a small telescope, it looks just like any other; using a little larger glass, it changes appearance and looks elongated; with a still better telescope, they become distinctly separated and appear as two beautiful stars whose elements are measured and carefully recorded, in order to see if they move. Herschel detected the motion of fifty of these systems, and revolutionized modern astronomy. Astronomers soared away from the little solar system, and began a minute search throughout the whole sidereal heavens. Herschel's catalogue contained 400 double suns, only fifty of which were known to be in revolution. Since then, enormous advance has been made. The micrometer has been improved into an instrument of great delicacy, and the number of doubles has swelled to 10,000; 650 of them being known to be binary, or revolving on orbits—Prof. S. W. Burnham, the distinguished young astronomer of the Dearborn Observatory, Chicago, having discovered 800 within the last eight years. This discovery implies stupendous motion; every fixed star is a sun like our own, and we can imagine these wheeling orbs to be surrounded by cool planets, the abode of life, as well as ours. If the orbit of a binary system lies edgewise toward us, then one star will hide the other each revolution, moving across it and appearing on the other side. Several instances of this motion are known; the distant suns having made more than a complete circuit since discovery; the shortest periodic time known being twenty-five years.

Wonderful as was this achievement of the micrometer, one not less surprising awaited its delicate measurement. If one walks in a long street lighted with gas, the lights ahead will appear to separate, and those in the rear approach. The little spider lines have detected just such a movement in the heavens. The stars in Hercules are all the time growing wider apart, while those in Argus, in exactly the opposite part of the Universe, are steadily drawing nearer together. This demonstrates that our sun with his stately retinue of planets, satellites, comets and

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meteorites, all move in grand march toward the constellation, Hercules. The entire Universe is in motion. But these revelations of the micrometer are tame compared with its final achievement, the discovery of parallax.

This means difference of direction, and the parallax of a star, is the difference of its direction when viewed at intervals of six months. Astronomers observe a star to-day with a powerful telescope and micrometer; and in six months again measure the same star. But meanwhile the earth has moved 183,000,000 miles to the east, so that if the star has changed place, this enormous journey caused it, and the change equals a line 91,400,000 miles long as viewed from the star. For years many such observations were made; but behold the star was always in the same place; the whole distance of the sun having dwindled down to the diameter of a pin point in comparison with the awful chasm separating us from the stars. Finally micrometers were made that measured lines requiring 100,000 to make an inch; and a new series of observations begun, crowning the labors of a century with success. Finite man actually told the distance of the starry hosts and gauged the universe.

When the parallax of any object is found, its distance is at once known, for the parallax is an arc of a circle whose radius is the distance. By an important theorem in geometry it is learned, that when anything subtends an angle of 1″ its distance is 206,265 times its own diameter. The greatest parallax of any star is that of Alpha Centauri—$\frac{9}{10}$ of a second; hence it is more than 206,265 times 91,400,000 miles—the distance of the sun—away, or twenty thousand billions of miles. This is the distance of the nearest fixed star, and is used as a standard of reference in describing greater depths of space. This is not all the micrometer enables man to know. When the distance separating the earth from two celestial bodies that revolve is learned, the distance between the two orbs becomes known. Then the period of revolution is learned from observation, and having the distance and time, then their velocity can be determined. The distance and velocity being given, then the combined weights of both suns can be calculated, since by the laws of gravity and motion it is known how much weight is required to produce so much motion in so much time, at so much distance, and thus man weighs the stars. If the density of these bodies could be ascertained, their diameters and volumes would be known, and the size of the fixed stars would have been measured. Density can never be exactly learned; but strange to say, photometers measure the quantity of light that any bright body emits; hence the stars cannot have specific gravity very far different from that of the sun, since they send similar light, and in quantity obeying the law wherein light varies inversely as the squares of distance. Therefore, knowing the weight and having close approximation to density, the sizes of the stars are nearly calculated. The conclusion is now made that all suns within the visible universe, are neither very many times larger nor smaller than our own. (Newcomb and Holden's Astronomy, p. 454).

Another result followed the use of the micrometer; the detection of the proper motion of the stars. For several thousand years the stars have been

called "fixed," but the fine rulings of the filar micrometer tell a different story. There are catalogues of several hundred moving stars, whose motion is from ½" to 8" annually. The Binary star, 61 Cygni, the nearest north of the equator moves 8" every year, a displacement equal in 360 years to the apparent diameter of the moon. The fixed stars have no general motion toward any point, but move in all directions.

Thus the micrometer revealed to man the magnitude and general structure, together with the motions and revolutions of the sidereal heavens. Above all, it demonstrated that gravity extends throughout the universe. Still the longings of men were not appeased; they brought to view invisible suns sunk in space, and told their weight, yet the thirst for knowledge was not quenched. Men wished to know what all the suns are made of, whether of substances like those composing the earth, or of kinds of matter entirely different. Then was devised the spectroscope, and with it men audaciously questioned nature in her most secluded recesses. The basis of spectroscopy is the prism, which separates sun-light into seven colors and projects a band of light called a spectrum. This was known for 300 years, and not much thought of it until Fraunhöfer viewed it with a telescope, and was surprised to find it filled with hundreds of black lines invisible to the unaided eye. Could it be possible that there are portions of the solar surface that fail to send out light? Such is the fact, and then began a twenty years search to learn the cause. The lines in the solar spectrum were unexplained until finally metals were vaporized in the intense heat of the electric arc and the light passed through a spectroscope, when behold the spectra of metals were filled with bright lines in the same places as were the dark lines in the spectrum of the sun. Another step; if when metals are volatilized in the arc, rays of light from the sun are passed through the vapor and allowed to enter the spectroscope, a great change is wrought; a reversal takes place, and the original black bands reappear. A new law of nature was discovered, thus: "Vapors of all elements absorb the same rays of light which they emit when incandescent." Every element makes a different spectrum with lines in different places and of different widths. These have been memorized by chemists, so that when an expert having a spectroscope sees anything burn he can tell what it is as well as read a printed page. Men have learned the alphabet of the Universe, and can read, in all things radiating light, the constituent elements. The black lines in the solar spectrum are there because in the atmosphere of the sun exist vapors of metals, and the light from the liquid metals below is unable to pass through and reach the earth, being absorbed kind for kind. Gaseous iron sifts out all rays emitted from melted iron, and so do the vapors of all other elements in the sun, radiating light in unison with their own. Sodium, iron, calcium, hydrogen, magnesium and many other substances are now known to be incandescent in the sun and stars; and the results of the developments of the spectroscope may be summed up in the generalization that all bodies in the Universe are composed of the same substance the earth is.

The sun is subject to terrific hurricanes and cyclones, as well as explosions, casting up jets to the height of 200,000 miles. In the early days of spectroscopy these protuberances could only be seen at a time of a total solar eclipse, and astronomers made long journeys to distant parts of the earth to be in line of totality. Now all is changed. Images of the sun are thrown into the observatory by an ingenious instrument run by clock work, and called a Heliostat. This is set on the sun at such an angle as to throw the solar image into the objective of the telescope placed horizontally in a darkened observatory, and the pendulum balset in motion, when it will follow the sun without moving its image, all day if desired. At the eye end of the telescope is attached the spectroscope and the micrometer, and the whole set of instruments so adjusted that just the edge of the sun is seen, making a half spectrum. The other half of the spectroscope projects above the solar limb, and is dark, so if an explosion throws up liquid jets, or flames of hydrogen, the astronomer at once sees them and with the micrometer measures their height before they have time to fall. And the spectrum at once tells what the jets are composed of, whether hydrogen, gaseous iron, calcium or anything else. Prof. C. A. Young saw a jet of hydrogen ascend a distance of 200,000 miles, measured its height, noted its spectrum and timed its ascent by a chronometer all at once, and was astonished to find the velocity 160 miles per second; eight times faster than the earth flies on its orbit. By these improvements solar hurricanes, whirlpools and explosions can be seen from any physical observatory on clear days.

The slit of the spectroscope can be moved anywhere on the disc of the sun; so that if the observer sees a tornado begin, he moves the slit along with it, meas ures the length of its track and velocity. With the telescope, micrometer, heliostat and spectroscope came desire for more complex instruments, resulting in the invention of the Photoheliograph, invoking the aid of photography to make permanent the results of these exciting researches. This mechanism consists of an excessively sensitive plate, adjusted in the solar focus of the telespectroscope. In front of the plate in the camera is a screen attached to a spring, and held closed by a cord. The eye is applied to the spectroscopic end of the complex arrangement to watch the development of solar hurricanes.

Finally an appalling out-burst occurs; the flames leap higher and higher, torn into a thousand shreds, presenting a scene that language is powerless to describe. When the display is at the height of its magnificence, the astronomer cuts the cord; the slide makes an exposure of 1-3000 part of a second, and an accurate photograph is taken. The storm all in rapid motion is petrified on the plate; everything is distinct, all the surging billows of fire, boilings and turbulence are rendered motionless with the velocity of lightning.

At Meudon, in France, M. Janssen takes these instantaneous photographs of the sun, thirty inches in diameter, and afterward enlarges them to ten feet; showing scenes of fiery desolation that appalls the human imagination. (See address of Vice-President Langley, A. A. A.S., Proceedings Saratoga Meeting, p 56.)

This huge photograph can be viewed in detail with a small telescope and micrometer, and the crests of solar waves measured. Many of these billows of fire are in dimensions every way equal in size to the state of Illinois. Binary stars are photographed so that in time to come they can be re-taken, when if they have moved, the precise amount can be measured.

Another instrument is the Telepolariscope, to be attached to a telescope. It tells whether any luminous body sends us its own, or reflected light. Only one comet bright enough to be examined has appeared since its perfection. This was Coggia's, and was found to reflect solar from the tail, and to radiate its own light from the nucleus.

Still another intricate instrument is in use, the Thermograph, that utilizes the heat rays from the sun, instead of the light. It takes pictures by heat; in other words it sees in the dark; brings invisible things to the eye of man, and is used in astronomical and physical researches wherein undulations and radiations are concerned. And now comes the Magnetometer, to measure the amount of magnetism that reaches the earth from the sun. It points to zero when the magnetic forces of the earth are in equilibrium, but let a magnetic storm occur anywhere in the world and the pointer will move by invisible power. It detects a close relation between the magnetism of the earth and sun. The needle is deflected every time a solar disturbance takes place. At Kew, England, an astronomer was viewing the sun with a telescope and observed a tongue of flame dart across a spot, whose diameter was 33,700 miles. The magnetometer was violently agitated at once, showing that whatever magnetism may be, its influence traversed the distance of the sun with a velocity greater than that of light.

Not less remarkable is the new instrument the Thermal Balance devised by Prof. S. P. Langley Pittsburg. It will measure the 1-50.000 part of a degree of heat, and consists of strips of platinum 1-32 of an inch wide and ¼ of an inch long; and so thin that it requires fifty to equal the thickness of tissue paper, placed in the circuit of electricity running to a galvanometer. "When mounted in a reflecting telescope it will record the heat from the body of a man or other animal in an adjoining field, and can do so at great distances. It will do this equally well at night, and may be said, in a certain sense, to give the power of seeing in the dark. ("Science," issue of Jan. 8, 1881, p 12.) It is expected to reveal great facts concerning the heat of the stars.

Indeed, the Thermopile in the hands of Lockyer has already made palpable the heat of the fixed stars. He placed the little detective in the focus of a telescope and turned it on Arcturus. "The result was this, that the heat received from Arcturus, when at an altitude of 55°, was found to be just equal to that received from a cube of boiling water, three inches across each side, at the distance of 400 yards; and the heat from Vega is equal to that from the same cube at 600 yards." (Lockyer's Star Gazing, p 385.) Thus that inscrutable mode of force heat, traverses the depths of space, reaches the earth, and turns the delicate balance of the thermopile. Another discovery was made with the spectroscope; thus, if a boat

moves up a river, it will meet more waves than will strike it if going down stream. Light is the undulation of waves; thence if the spectroscope is set on a star that is approaching the earth, more waves will enter, than if set on a receding star, which fact is known by displacement of lines in the spectroscope from normal positions. It is found that many fixed stars are approaching, while others are moving away from the solar system.

We cannot note the researches of Edison, Lockyer or Tyndall, nor of Crookes, who has seemingly reached the molecules whence the Universe is composed.

The modern observatory is a labyrinth of sensitive instruments; and when any disturbance takes place in nature, in heat, light, magnetism, or like modes of force, the apparatus notes and records them.

Men are by no means satisfied. Insatiable thirst to know more is developing into a fever of unrest; they are wandering beyond the limits of the known, every day a little farther. They survey space, and interrogate the Infinite; measure the atom of hydrogen and weigh suns. Man takes no rest, and neither will he until he shall have found his own place in the chain of nature.

March 29th, 1881.

METEOROLOGY.

THE STORM CENTER AND WEATHER PROPHETS.

BY ISAAC P. NOYES, WASHINGTON, D. C.

The weather since the first of January 1881 has not even been as complimentary to Mr. Vennor as was that of December 1880, and re-affirms the statements so often made in these papers, in regard to the absurdity of attempting to guess at the weather, months, or even weeks in advance. Had we had the usual mid-January thaw, ignorant people and even many well informed people, would have claimed that it was all in accordance with Mr. Vennor's predictions and evidence of his great skill and knowledge in prophesying the weather.

Nine times out of ten it would be safe to venture a prediction, "that about the middle of January we would have a thaw," or at least some time in January. But this year for very simple reasons we did not have the thaw.

As stated in former papers, in winter, when the sun is south of the equator, the area of low-barometer travels on a lower line than during the summer months; and as the wind is always toward "low," it necessarily follows that the wind will be more generally from the north and hence cold. When the sun advances north the general effect is to advance the area of low-barometer to a higher line of latitude. Notwithstanding this general effect of the sun in developing *low*, and *low* being generally on a higher line in summer than in winter, there are times in sum-

mer when it is on a very low line, and times in winter when it is on a very high line. It seldom, if ever goes over exactly the same ground, though it often takes a similar course · and after running on one general line for a few times in succession, there will be a change to some opposite or extreme line, higher or lower, as the case may be.

So when fall sets in, the area of low-barometer creeps down relatively with the sun, and then as the sun advances north, this area of *low* goes north with it, yet all the while, with the changes herein spoken of intervening, making in summer north winds, and relatively cold days, and in winter southerly winds and relatively warm days. When one becomes familiar with these motions of *low*, or the concentration of the sun's heat, studies the causes, which day by day, week by week and month by month it follows—its regularity and irregularity—how steady at times it follows just where it would seem it ought to go, and how capricious at other times, as though it was determined to surprise man by both its regularity and irregularity; when we become cognizant of the laws which this department of nature follows; how it would seem bent on defying us to say when and where it will go, and when and where it will not go; when our senses perceive this, then and not until then will we realize the absurdity of the attempt to revive the old method of guessing at the weather for months in advance, or putting confidence in any person's attempt to indicate what the weather will be, from any pretended calculation of the movements of the moon or stars.

We all know that it is cold in winter and warm in summer, and that in the spring we will have blustering weather, cold winds and rain, and as the spring approaches summer, have what are known as "April showers"—sunshine and rain suddenly and closely interspersed. A little later, hot sultry days—long and protracted dry spells, with sudden changes and violent storms, accompanied with thunder and lightning. As the season advances, more evenly distributed areas of rain—days when it is quite cold and it would seem that winter had come, but it has not, for following this are those delightful hazy days in autumn, October and November, which are known in this country as "Indian Summer," for the reason that the first settlers thought on the first approach of cold weather, that winter had come, but the Indians told them that there would follow quite a spell of mild pleasant weather before the cold of winter really set in, and so it did and hence the name "Indian Summer." In those days the cause of this could not be explained, but to-day it can, and in former papers has been explained. Following this "Indian Summer" is the cold of winter, earlier in northern than in southern latitudes, (north of the equator) All this general knowledge of the weather of the months we know and knew before a weather bureau was established, or thought of, but we did not know the causes of the changes and their peculiarities.

There is no wisdom in any one telling us that it will be cold in winter or warm in summer, or generally that "July will be hot, with thunder storms,"or "December cold, with heavy falls of snow," for these are the things or conditions which naturally follow, and if they do not follow, form an exception in the weather of

the year. We are continually having these exceptions—in the days—in the weeks —in the months and in the years. These *exceptions* are a part of the regular things to be expected, but there is no regularity about them, however. If there were, the exceptional features would lose their character.

This area of *low* is a very coy thing on the part of nature. Now like a wise, benevolent and broad-minded philanthropist it dispenses its bounties evenly, visiting on its course one section and another, giving all alike, at least all sufficient; then a change and as it were, Peter is robbed to pay Paul, or even worse, Peter robbed and denied the essentials of life to drown Paul with; an overflowing abundance that is detrimental rather than beneficial to him. Let people simply study the weather map and this will all be revealed to them, and more, they will soon see the absurdity of any person attempting to make such prophecies in regard to the weather, and of the attempt to write or speak on the subject without this knowledge.

A sea-captain would be more reasonable in this day, to attempt to navigate the seas and oceans of the globe without compass, quadrant and charts. We can not know much about navigation by merely knowing a few general laws of physics. We must, in order to know navigation, have knowledge of the tides, the compass, know how to take the sun and how to work our way by the charts, light-houses, buoys, etc. So when it comes to a knowledge of the weather, we must know a little more than the general laws of physics; we must make ourselves familiar with the movements of the sun in the ecliptic, with the parallelism of the earth, with the topography of the land, the distribution of land and water, of plains and mountains, and foliage, and even with the advancement of civilization. For, where civilization goes railroads are sure to follow, and it seems now to be well known and admitted, that railroads under certain relations to territory have more or less effect.

On the Western plains, where little or no rain occurred before the advent of the railroad, rain is now said to be quite frequent. The cause of this would seem to be that the iron rails attract the rays of the sun, and develop and retain heat, thereby making an area of low barometer practical in such localities, where before the dryness of the country repelled it or so neutralized it as to make it non-effective. This re-acts and produces trees, and so soon as foliage is developed, all the essential features for developing and retaining a *low* or making it a practical reality is secured. For *low* will not remain over night and thereby be sufficiently permanent to secure moisture to the land unless there is something to retain the heat developed by the sun.

Where there is moisture there is more material to form clouds, and where this moisture is the more clouds will hover over the spot and the factor *heat* be retained, by which other clouds are brought there to precipitate. This reveals to us the mystery of the superiority of territory where land and water are well distributed, and the necessity of restoring the balance where it is practicable. Land and water are both essential to our well being; organized as we are, we could not

live here without the two in at least fair proportions to retain such a balance of heat and cold, dryness and moisture, as is essential to human life. So the forces of nature, like the artificial forces, developed by civilized man, act and re-act upon each other. Let a few persons establish themselves in a certain spot, others follow in order to meet the demands of trade, supplies, and even luxuries. Their demands as individuals and as a settlement increases as the settlement grows. Nature works on a similar plan. Take an arid country—too dry and suddenly tempestuous for habitation; civilization advances to it. The railroad passing through it develops a capacity to retain heat; some humanitarian, like the man who planted the acres of pines along the desert wastes of Cape Cod, in Massachusetts, some man with an eye to the future, starts a few trees, and perhaps, at great expense, an Artesian well, or conducts water from some distant and more favored locality; it may be for his own selfish gain, yet he cannot enjoy his gain alone; indeed his gain becomes greater as others enjoy it with him; he and his neighbors act and re-act upon each other. This little water, this railroad, these few trees, are the nucleus. Other similar things follow and act and re-act upon each other, and teach the lesson and wisdom of the benefits to man, individually and collectively, by generosity, combination and the bringing together of natural forces, and how one set of natural forces may, to the great advantage of man, be made to neutralize another set, and that with advanced civilization come even blessings that we little dreamed of, and reveal to us what a generous thing nature is if we will only court her in a becoming manner. She is ever more ready to give than we to receive, if we will only have the wisdom to deal with her as we should. Nothing more than this teaches man, or more strongly reveals to him the importance of studying nature, and making himself familiar with the works of nature, and acting generously toward his fellow man. For we are so constituted that the more we elevate what is about us the more we elevate and benefit ourselves.

It would seem that mere selfishness would prompt men to such acts, but the trouble with mere selfishness is that it is very short sighted, and works for the immediate present rather than the eternal future. He who acts for the immediate present is necessarily interested in ignorance, for his whole trust is in this element whether he be honest or deceptively pretentious.

A person who pretends or is simple enough to think that he can figure out the weather, months in advance, is either ignorant himself of the laws which govern the weather, or presumes that his fellows are, and perhaps both, and in either case his dependence is in the ignorance of his fellow men rather than in their enlightenment.

After January had passed and we had entered February, Mr. Vennor comes out with a card and admits that the January thaw did not take place. He had made some miscalculation or other, and the *thaw had been crowded out by the extreme cold.* (*!*).

If Mr. Vennor had known what caused the continued cold weather of December and January, would it not seem natural that he should have informed the

public, but he seems to be as innocent and ignorant of it as an unborn babe, for he tells us that the thaw was *crowded out* (!). Yet it is said that this man is a scientist, at the head of the Canadian Meteorological Bureau, and a scientific man. I would like to see some medical man give some medical reason for the non-occurrence of something in his line on a par with this; some statesman; some lawyer—scientist or artist, attempt to hood-wink the public with *such a reason* (!).

If he were a person worth noticing the press of the land would soon make him the laughing stock of the age. The simple reason why we so often have a thaw in mid-winter is because of a high area of low barometer—that is, a number, say three or four or more areas of low barometer running on a high line of latitude with no similar area in the South to neutralize it. This causes south winds and gives us rain and thaw at the North, the result of which is to break up the ice and to sufficiently melt the snows to flood the streams, carrying off the ice and snow at least in part. We did not have this, at least, to any extent this year, for the reason that *low* was generally on a low line of latitude producing extreme cold with heavy rains, and even snow in the extreme Southern states.

They had more snow in New Orleans, in consequence, this year, than perhaps ever before. Snow in New Orleans is a very uncommon thing and had some person told the world, or even made a venture that such a thing would have occurred, by those ignorant of science he would have been termed a weather prophet indeed. It was an exceptional thing and the weather-map reveals the cause thereof, as well as a chart of the ocean which shows a dangerous reef would reveal the cause of the destruction of a vessel that was wrecked thereon. Now there is one thing these "weather prophets" may do, whereby they may obtain notoriety with the uninitiated, and that is to take the weather-map, study it for awhile in order to make themselves familiar with the workings of "High" and "Low" and then venture a daily guess of three or four days ahead of the Signal Office, and if they are expert, they may come pretty near the mark.

Indeed it would seem that it was full time that the Signal Office took a new departure and advanced a step. It is sure to come some day, and as they have the best facilities, it would seem that they were the ones to do it, and that is, in addition to their present daily "Indications," have a sub-indication, which will be understood not to be so reliable, and one in which they may be allowed more latitude. Let the basis on which they would make these new advanced indications be understood, then intelligent people will not hold them responsible, but will with them take the chances.

The better the public understand the weather-map the better will this be revealed to them, and the better they will understand the duties and difficulties of the Signal Office if they should undertake this new departure. If they assume this extra task they might adopt some new term, which will not be so positive as the term at present used for the daily information given to the public. But whatever the term may be, let it be distinctly understood that the greater the time in advance, the more uncertainty; still, oftentimes the weather for three or four days

in advance, may be quite correctly given or revealed. If the Signal Office does not do this in course of time, some enterprising outsider will be sure to, and he will use their knowledge and material to accomplish it.

It would seem that it was full time that they added this auxiliary feature to their present daily indications. The intelligent world at least will be charitable toward them, and will not hold them too closely to the mark, and if they have the intelligent and generous people on their side, those who are able to understand the whys and wherefores, they need not fear the ignorant and exacting. The more the weather subject is understood, the more charity will the intelligent people of the country have for this office, and the more will they appreciate its labors, and the less respect will this same intelligent class have for all those would-be weather-prophets, who are assuming so much ignorance on the part of the public at large, and pretending to know so much more than other people, and more than the facts in the case will warrant. It is full time that the intelligent people of the world took hold of this subject and mastered it. They will find enough in it to fully repay them for the pains, and it will protect them against the imposition that at present they are so susceptible to and unprotected against.

KANSAS WEATHER SERVICE OBSERVATIONS AT WASHBURN COLLEGE, TOPEKA.

BY PROF. J. T. LOVEWELL.

Our last report closed February 20th, and the eight days succeeding gave us milder weather with no precipitation or storms, and the lowest temperature was 8°. During the first two decades in March the weather has further moderated. The heaviest fall of snow of this period was on the 7th, when about four inches of damp snow fell. It also snowed on the 2d and 17th; and rained on the 10th and 15th. The most noticeable phenomenon was the extremely low barometer on the 11th, when the reading was 28.12 at 9 p. m.; this is nearly .3 of an inch lower than observed at this station for more than two years, No storm occurred here during or immediately after this. There was thunder and lightning on the 14th and 15th. The first prairie fire occurred on the 13th. The highest temperature was 59°, on the 15th. The pressure has been below the average during the past month. The weather has been rather cold for the season, but we must regard it on the whole as favorable to vegetation, and there has been no premature starting of the buds. The following averages by decades will give a more complete statement of these facts. Robins were first seen here this year on Feb. 22.

	Feb. 21st to 28th.	Mar. 1st to 10th.	Mar. 11th to 20th	Mean.
TEMPERATURE.				
Min.	17 4	20.6	24 9	21.0
Max.	41.5	41 4	47 3	43.4
Mean of Max and Min.	29.4	31 0	36.1	32.2
Range.	24 1	20 8	22.4	25 8
7 a. m.	20 6	23 6	29 3	24 5
2 p. m.	34.1	37 6	40.5	37 4
9 p. m.	27.5	29.9	33.0	30 1
Mean	27.9	30.2	34.0	30.7
REL. HUMIDITY.				
7 a. m.	.89	. .	.78	.83
2 p. m.	.74	. .	.76	.75
9 p. m.	.81	. .	.83	.82
Mean	.80	. .	.78	.79
PRESSURE, sea-level, 32° F.				
7 a. m.	28.95	28.85	28 77	28.86
2 p. m.	28 91	28.81	28 74	28.85
9 p. m.	28 94	28.83	28 77	28 85
Mean	28.93	28.83	28.76	28.84
WIND.				
Miles Traveled	3,050	4,075	5,078	12,203
RAIN.				
Inches	..	1.09	.25	1.34

CLOUDS—TORNADOES AND ELECTRICITY.

S. A. MAXWELL, MORRISON, ILL.

Many theories have been advanced to account for the marvelous freaks played by tornadoes. Some who have examined into it, have asserted that these frightful storms are caused by the rushing together of two currents of air from different directions; others maintain that the phenomenon itself, and the remarkable circumstances attending, are both due to the action of electricity. In my opinion the holders of both these theories are "partly in the right and partly in the wrong."

Every one is familiar with the little whirlwinds, which are so common in dry, warm weather in the spring. These never occur on cloudy days, for the reason that heat is not generated at the surface of the earth in sufficient quantity to produce ascending currents of air. That there is a strong upward current in the center of the whirl, both in ordinary whirlwinds and in tornadoes, has many times been proved by observation. Where such current is formed, from whatever cause, the tendency is to produce a vacuum at the surface of the earth directly beneath; but this is prevented, since the surrounding air, in obedience to a well-known physical law, rushes in trom all sides, and, finding no other outlet, escapes upward with the ascending current, whose destructive power is thus greatly increased by the additions produced by its own action. The rushing together of these under currents almost invariably causes a rotary or whirling motion, on account, no doubt, of their unequal velocities and densities. This whirling motion is familiar to all; for it is seen in the little eddies, produced where rapid currents in a stream of water mingle with those of slower motion, or with the waters of a stagnant pool. The surface air being warm and moist, in ascending as described, is suddenly cooled, and therefore condensed into a thick cloud, which, on account

of the centrifugal force produced by its rotary motion is thrown outward, forming the so-called funnel or tornado cloud. Sometimes the forward movement of this cloud is very rapid, often with a bounding motion, passing for some distance high in air, and anon, descending to the earth, where it destroys everything in its path, —the strongest works of man's genius or mechanical skill, beind demolished in an instant; and trees that have withstood the ordinary storms for ages, at once falj prostrate by a single breath of this irresistable destroyer.

Now the question arises, does electricity play any part in the production of these phenomena? It is a fact that there is a large amount of electricity exhibited during these storms; but I would rather believe that certain peculiar manifestations of electrical action are due to the phenomena above stated,—viz., the mingling of currents, the condensation of vapor. etc., than that the tornado itself is the result of electricity. I think, however, that after the formation of the tornado is complete, there are numerous phenomena caused by the electric force. Every object directly underneath the funnel is electrified, so also is the funnel, but with the opposite kind of electricity. According to Prof, Henry, the base of a cloud is charged with positive, and the surface of the earth with negative electricity. There is a great tendency on the part of electrified substances to rush together if charged with opposite electricities; and conversely, just as strong repellent action when both are positive or both negative. It is also true that any object strongly electrified instantly imparts its own species of electricity to an object in contact with it, and immediately tbrows it off or repels it violently. These facts clearly account for many of the astonishing phenomena, which occur during the passage of the tornado. If we place upon a flat surface, as a table, a lot of iron filings, and pass a magnet along about an inch above them, each little metallic particle will stand upon one of its extremities, and perhaps some of them will rush through the intervening space and attach themselves to the magnet. It is nearly the same phenomena in the tornado:—the objects lying on the earth's surface are the metallic filings, the funnel cloud of the tornado is the magnet. Though the phenomena are similar, in the two instances, there is a vast difference in their effect.

It is said that the stem of the tornado cloud, when extending toward the earth, but not reaching it, sometimes becomes incandescent or apparently red-hot from the electricity which it accumulates. I have never observed this appearence, but many instances have been noted by observers both in this country and in Europe.

These, then, are the conclusions drawn from observation and research concerning the connection of electricity with the tornado. These meteors are less rare than many suppose; for by keeping a careful watch, we, who are residents of the upper Mississippi valley, may see one as often as once in three years. Some tornadoes, however, do little or no damage, passing along a short distance and are then absorbed by the clouds above them, and are seen no more.

As regard tornadoes, they seldom occur in the forenoon, but generally between the hours of two and eight, p. m.—the Tampico (Ill.) tornado, of June 6th,

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1874, was, however, an exception to this rule, occurring about 11 o'clock at night;—also, the one at Leavenworth, Kas., May 6th, 1875, which happened at 3:20 in the morning.

It is needless for me to enlarge upon this portion of my subject, since my own views differ so widely from those of the public generally that a proper presentation of them would not be possible in an article intended to be brief. At some future time I trust I shall be able to furnish to the readers of the "Review" an article on tornadoes, which will be more instructive than the one on *Clouds*, which is now brought to a close.

ETHNOLOGY.

THE PUEBLO INDIANS.

JAMES C. PILLING, U. S. BUREAU OF ETHNOLOGY.

The Pueblos of New Mexico and Arizona are towns or villages inhabited by Indians of various races and speaking different languages. When we omit the Indians inhabiting the Middle Gila river, who are also sometimes spoken of as Pueblo Indians, the languages of the others are divisible into four families.

THE SHINŬMO (sometimes called Mòki) speak a language of the Sho-sho-ni-an, considerably differing, however, from the neighboring Pai-Ute, Uta and Califor. nia dialects of this family. They occupy six of a group of seven Pueblos—the seventh speaking a language of the Téwan—each under its own chief. These are the only Pueblos in Arizona, the remainder being within the limits of New Mexico.

The following authors are known to have written or left manuscripts on this language:

PALMER (Dr.)—Vocabulary of about 200 words (MSS.)

PALMER (Capt. A. D.)—Vocabulary of about 200 words (MSS.)

SIMPSON (J. H.)—Vocabulary of the Moqui; 38 words. [In Journal of a Military Reconnaissance, &c., Wash.: 1850, 8°.] reprinted in

BUSCHMANN (J. C. E.)—"Völker und Sprachen New Mexicos." Akad. der Wissenschaften. Berlin: 1856, 4°.

LOEW (Oscar)—Vocabulary of about 200 words and some elements of grammar: In Gatschet (A. S.) "Zwölf Sprachen." Weimar: 1876, 8°.

POWELL (Maj. J. W.)—Vocabulary of the Shinümo, taken at Oraibi, one of the Pueblos. (MSS.)

THE ZŬNIAN—Zuñi (pron. Sùnyi), a comprehensive name given to three inhabited, and as many ruined Pueblos in Northwestern New Mexico, south of the Navajo Reservation: Zuñi, Old Zuñi or Cibola (ruined).

The linguistic literature is as follows:

SIMPSON (J. H.)—Vocabulary of Zuñi; about 40 words in "Journal of Military Reconnaissance, &c.," pp. 140–143. Wash. 1850, 8°.

EATON (Capt. J. H.)—Vocabulary, including numerals. (In Schoolcraft, Vol. III., pp. 416-432).

WHIPPLE (Lieut. A. W.)—Vocabulary in Pacific R. R. Rep. III. 2, pp. 91-93. All the above reprinted in

BUSCHMANN (J. C. E.)—"Völker und Sprachen New Mexicos." Akad. der Wissenchaften. Berlin: 1856, 4°.

PALMER (Dr.)—Vocabulary of about 60 words (MSS).

KLETT (Francis)—The Zuñi Indians of New Mexico. In Popular Science Monthly, N. Y.. 1874, pp. 580-591 (Illus. ethnological).

STEVENSON (J. S.)—List of names given to Zuñi pottery, 1879 (MSS).

KÈRAN.—Kèra, Span. Quera, plur. Qüeres; an ancient name of unknown signification given to Pueblo Indians west of the Rio Grande. Locally they are divided into two branches: 1. A northeastern branch on the Rio Grande, embracing San Felipe, Santo Domingo, Còtchite, Santa Aña and Cìa (Silla, Tse-a). 2. A western branch on-the Rio San Juan: Kawaikome; Laguna, Povate; Hasatch, Mogino.

The linguistic literature is as follows:

SIMPSON (J. H.)—Vocabulary of Kèra, about 30 words. [In "Journal of Military Reconnaissance. &c." Wash.: 1850, pp. 140-143, 8°.]. Reprinted in

DAVIS (W. H. H.)—"El Gringo, or New Mexico and Her People," N. Y., 1857, pp. 157-159, 8°.

WHIPPLE (Lieut. A. W.)—Vocabulary of Kiwomi, about 200 words, and of Cochitemi, about 60 words. [In Pacific R. R. Report III., 2, pp. 86-89.]

The above reprinted in

BUSCHMANN (J. C. E.)—"Völker und Sprachen, New Mexicos." Akad. der Wissenschaften. Berlin: 1856, 4°.

LOEW (Oscar)—Vocabulary of Santa Aña, about 200 words and a few sentences. [In Gatschet (A. S.) "Zwölf Sprachen" Weimar, 1870, 8°.

LOEW (Oscar)—Vocabulary in Lagüna. (Ibid.)

KLETT (Francis)—Vocabulary of Acoma, about 60 words, 1873. (MSS.).

WENAUL (John)—Teacher of Laguna; Specimens of Laguna primer and catechism, with interlinear English translation. (MSS.)

TÈWAN.—The largest number of Indian towns in New Mexico, along the Rio Grande, speak dialects of the Tēwan. It seems that in former times these dialects extended far into Texas and Chihuahua along the same river, though only a few scattered remnants of them are now remaining there.

Of this family five main divisions may be made, these being mutually unintelligible:

1. Taño: Isleta; another Isleta near El Paso; Sandia.
2. Taos: Taos (Indian, Taxē) Picuni.
3. Jemes: Jemes (old Pecos is consolidated with it).
4. Tewa or Tehua ("house, houses") San Ildefonso, San Juan, Pojoaque,

Nambe, Tesuque, Santa Clara and one of the Moki Pueblos. Of these Pueblos, Santa Clara is the only one located on the western bank of the Rio Grande.

5. Piro in Sinecù, south of El Paso.

LINGUISTIC LITERATURE.—SIMPSON (J. H.)—Vocabulary of Jemes, etc., 30 words, pp. 140–143; reprinted in Davis' "El Gringo."

WHITING (David V.)—Vocabulary of Tesuque, about 400 words. [In Schoolcraft III, 446–450.]

The above reprinted in

BUSCHMANN (J. C. E.)—"Völker und Sprachen." Berlin: 1856, 4°.

LOEW (Oscar)—Isleta, Jemes, San Ildefonso, San Juan. Vocabulary of about 230 words each, and sentences from Tesuque (about fifty). [In Gatschet (A. S.) "Zwölf Sprachen." Weimar: 1870, 8°.

PALMER (Doctor)—Vocabulary of Taowa (MSS.)

BARTLETT (J. R.)—Vocabularies of Piro, of Sinecù, of Tigua (viz: Tèhua, Tewa. MSS.)

YARROW (Dr. H. C.)—Vocabulary of Los Lüceros. (MSS).

YARROW (Dr. H. C.)—Vocabulary of Los Taos. In Gatschet (A. S.) "Zwölf Sprachen." Weimar: 1870, 8°.

KANTZ (Aug V.)—Vocabulary of Isleta, 1869. (MSS.)

GIBBS (Geo.)—Vocabulary of Isleta, 1868. (MSS.)

CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

PARIS, January 1, 1881.

The problem of prehistoric times—of primitive man, is a modern problem, and one which has provoked a passionate interest even in spheres outside science, because everybody feels that with the question of our origin is tied in some sort by a thousand cords—not only that of our actual, but of our future destiny. The ideas of transformation since ten years have made astonishing progress; but in their wake have also followed exaggerations; the Germans, in pushing theories to their utmost limit, have only arrived to be absurd. At present there is a kind of relative calm on the part of those who study seriously the delicate question of the origin of animals; they find themselves in the face of questions unsolved—that changing the place of a miracle does not resolve it, and that in all phenomena science halts in the presence of the inexplicable. Those who desire to approach the grave matters in question, in this spirit, cannot do better than read M. de Nadaillac's two volumes on *Les Premiers Hommes*. It is a calm, impartial and independent examination of all the evidence and discoveries known, up to the present. Man—yes or no; has he lived during the tertiary period? That's the question. There are scientists who would place the origin of man not only in the

pliocene, but the miocene, and even the eocene periods—a classification of the tertiary formation made fifty years ago by Sir Charles Lyell, and founded on the variable proportion of shells of species still living, mixed at the same time with others fossilized. As negative are not of the same value as positive proofs, there are geologists who see in cut flints and bones conclusive evidence of man's antiquity. Now, in the first place, are these objects contemporary with the strata in which they have been found; secondly, is it absolute certainty that these objects have been manipulated by a human being? It is in the fauna immediately following the pliocene period that the flint existence of man, it is generally admitted, is to be found. The first traces of man in Western Europe are flints simply broken, not fashioned, and of a nature to serve immediate wants; he lived in a *milieu* of strange fauna, where the animals of northern, temperate and southern zones were associated. The Abbe Bourgeois has discovered an immense number of small cut flints, and has, accordingly, placed man in the miocene period. Respecting this, M. de Nadaille pertinently asks, of what use these remarkably small flints could be to man, cut, as they must have been, with much effort and great labor; they were useless either for attack or defense, and still less for an implement or a tool. Neither have the alleged discoveries of human bones in tertiary strata been confirmed when subjected to rigorous analysis. The origin of humanity is still shrouded in mystery; paleontology and zoölogy, no more than geology, have yet found out the exact cradle of our species, nor to link it to some other anterior species. There are points of union which have escaped demonstration; there are veritable *lacunes* which render classification difficult; there are variations impossible to explain. These remarks do not touch what is in the man—the supreme form of indifference, intelligence, articulated language, perfectibility.

Professor Fredericy, of Liege, has investigated the subject of the coagulation of the blood. Extracted from the organism, blood solidifies, forms a mass called fibrine; the same remark applies to lymph. Before coagulation, blood consists of globule and a liquid called plasma; after coagulation of globules, serum and fibrine. Deprived of the latter, the blood does not coagulate. If blood be beaten up or whisked with a piece of whalebone, in a vessel, the fibrous masses will adhere to the rod, while the serum, holding the globules in suspension, will remain liquid. This is the process employed in the slaughter houses to prevent the coagulation of pigs' blood, so essential for making black puddings. But from where comes this fibrine? It cannot be attributed to the new conditions in which it is placed, for neither cold, air, nor rest, nor the combination of the three can explain the phenomena. The principle of coagulation coming, not from an external cause, is it to be attributed to an internal one? So long as blood is in contact with the coats of the vein, etc., it will not coagulate—for a long time. Even in dead bodies, the blood is only imperfectly coagulated. But if a foreign body be introduced into the vein coagulation will set in. Since the end of the sixteenth century it has been known that it is in the liquid part of the blood—the

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plasma—and not in the red globules, that the generation of fibrine must be found, and the commencement of the formation of fibrine is always marked by the agglutination of several white globules. Now, according to Schmidt, these white globules form a ferment of fibrine; this ferment does not exist in the blood during circulation; it is formed the moment the blood quits the vessels and comes in contact with foreign bodies; it is derived from the white globules, hence the ferment does not exist whilst the blood circulates; if the ferment be injected into the veins of a living animal, it is quickly destroyed. The white globules, on leaving the blood and coming into contact with a foreign body, are irritated, and that produces the ferment.

M. Engineer Roche has published a very interesting report on the Trans-Saharian railway, by which France is studying to connect her colonies at the Laborn and Sivegne with Algeria. No difficulties exist under the heads of sandhills and water; the latter "will be found in all the Sahara in sufficient quantity for the wants of the railway." The construction of the line will be extremely easy: the soil will be the ballast; no masonry work will be required. The only difficulty is the want of coal, which must be brought from the seaside. M. Roche does not despair of utilizing the solar heat, by means of the apparatus Mouchot, or rather reflector, indirectly, of course, with compressed air.

M. Delisrain has concluded his examination of the origin of carbon in vegetables; it is the chlorophyll cell which reduces the carbonic acid, and so elaborates the organic matter; the latter cannot enter into circulation, according to some authorities, unless it be a second time burned.

M. Panchon's careful experiments on the influence of light on germination, are very interesting. He has found that the lighter the grain the more rapidly it germinates. Owing to the difficulty of not having identical volumes of heat, for two different seeds, no serious comparison under the head of temperature could be made. Light exercises an influence more or less accentuated on germination, by forming the absorption of oxygen; heat diminishes the importance of the influence of light, but the quantity of oxygen absorbed augments with the elevation of the external temperature. More carbonic acid is given off during obscurity; the latter would appear to be in some cases a condition favorable to the development of certain seeds.

It was an old doctrine, because taught by his parents, that epidemics are influenced by the seasons, the soil, atmosphere, cold, heat and humidity. The doctrine was overthrown by Broussais, who placed all the disease in the subject in the evolution of the morbific element, and that nothing but the medical treatment could modify. A reaction has set in; it is now considered a truism that there is a close connection between epidemics and climatic influences. Since twenty years Dr. Besnier has been delegated by the Medical Society of Paris to collect and study all the facts bearing on the point. Typhoid fever is a morbid type to be met with in every country, with all human races, and at every epoch

of the year. France is the classic land of this disease and Paris its head center. Naturally, Dr. Besnier has concentrated his attention on Paris, where one-twelfth of the deaths, or 1,200 per year, are due to typhoid fever. Now the number of these deaths are not regularly divided as to the seasons—during spring the deaths from the malady are less than one-half what they are in autumn; the maximum of mortality is during the months of July and October; twelve per cent. of the persons afflicted with typhoid fever succumb—that is to say, eighty-eight are cured. To well combat the fever not only the diagnosis ought to study the individuality of the patient, the intensity of the disease, but also the season—summer temperature develops while augmenting the malady, and autumn maintains it in its aggravated form. Atmospheric influences, concludes the Doctor, are momentous factors in typhoid fever, but they do not produce all their effects nor become fruitful, only when encountering local and individual conditions of a favorable character.

Sydenham said that if any one would devote his life to finding a cure for corns, he would merit the thanks of posterity and of humanity at large. The skin is a soft, delicate membrane, very elastic; its color is rose with the infant and with the adult, following individuality, race, climate and season; it is very fine on the eyelids, but relatively thick on the palm of the hands and the soles of the feet. Skin consists of two layers—epidermis and the other more profound; the dermis. Everywhere there is a section of unctuous matter save on the palm of the hands and the sole of the foot; it is by the orifices that the perspiration exudes. A corn is a superficial tumor on the epidermis, with a root which penetrates more or less profoundly into the dermis—often deeper still; hence, why the ancients called corns *clavi pedum*, or feet nails, on account of their resemblance to ordinary nails. The *welt* is the commonest form of a corn; it is a combination of layers of the epidermis produced by unequal pressure of a boot or the irregular plait of a stocking; it is also the result of professional work. The monks that wear sandals are martyrs to such corns. A welt differs from a corn in being on the surface, where it always remains; the corn is conical and pierces downward; often certain of these excrescences become deformities. In 1599, Marshal Lavardin brought to Paris a man having a horn on his head as long as a goat's; in 1855 there was a Polish girl, aged 15, who had sixteen corns growing on different parts of her body—one springing even from the knee. Dr. Decaisne says that, relatively, our feet are not less deformed than those of Chinese ladies—the imprisonment of the foot being only the difference of degrees. Paring is the cure for welts; extraction for corns; caustic agencies ought to be avoided.—F. C.

Lieut. R. M. Berry, of the United States navy, has been ordered to command the steamer Mary and Helen on the proposed Arctic expedition in search of the Jeannette. Secretary Hunt furnished Lieut. Berry with a list of the naval officers who volunteered for the service, and he will be guided by any preferences he may entertain in the make-up of the detail of officers who will serve under him.

XUM

BOOK NOTICES.

PROCEEDINGS OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA. Part III, October to December, 1880; pp. 457, 8vo.

For a period of nearly seventy years this academy has maintained its existence. It has published more than fifty volumes of its Journal. Transactions, besides other works written by its members as contributions to science. Among the most active members at present are Professors Leidy and Meehan, Doctor Harrison, Rev. H. C. McCook and Messrs. Martindale, Potts and Heilprin, all of whom have contributed to the present volume the results of original investigation in botany, zoölogy, etc. At the election held at the close of the year, most of the officers were re-elected, including the able and experienced president, Dr. Ruschenberger, the zealous and attentive secretary and librarian, Dr. Edward J. Nolan, and others who have served faithfully for many years.

THE ROMANCE OF ASTRONOMY. By A. Kalley Miller, M. A.; quarto; pp. 28, J. Fitzgerald & Co., N. Y., 15c.

This is number 20, volume I, of the Humboldt Library, and, as usual, is an interesting and instructive number, comprising a popular account of the Planets Astrology, The Moon, The Sun, The Comets, La Place's Nebular Hypothesis, The Stars, The Nebulæ, The Past History of Our Moon, Ancient Babylonian Astronomy—the last two written by Prof. R. A. Proctor.

A STUDY OF THE SAVAGE WEAPONS AT THE CENTENNIAL EXHIBITION. By Edward H. Knight, A. M., LL. D., 8vo.; pp. 85.

We are indebted to Professor Otis T. Mason, of Columbian College, Washington, D. C., for this volume, which comprises simply an account of one class of objects s own at the Centennial Exhibition at Philadelphia in 1876,

Inasmuch as there was no concurrence of design on the part of the various exhibitors from all parts of the world in presenting these specimens of savage weapons, and they were mainly thrown in, as it were, with other objects, as curi osities, it is highly creditable to Doctor Knight that he has been able to classify them and illustrate so well by them the ethnology of the tribes formerly using them. There are nearly one hundred and fifty engravings, representing the weapons of all nations in all stages, while the text is graphically descriptive of all. People who have any taste for ethnological studies, will be much pleased and instructed by a perusal of this work.

THE SCHOOL BULLETINS. Published by C. W. Bardeen, Syracuse, N. Y., 1881.

These include the New York Examination Questions, 25c; Suggestions for Teaching Fractions, by W. W. Davis, 25c, and a List of the Regents Schools of

the State of New York with names of the Principals, 25c, and will be found very useful to school boards and teachers in all classes of schools.

OTHER PUBLICATONS RECEIVED.

Our Home and Science Gossip; No. 4, Vol. V, March, 1881, 4to 16 pp., Rockford, Ill., $1 per annum. The Dial; a monthly index of current literature, Jansen, McClurg & Co., Chicago, 4to, pp. 24, $1 per annum; Report of Atmospheric Physics, by N. E. Ballou, M.D., Sandwich, Ill.; Pueblo Pottery (illustrated), by Prof. F. W. Putnam, 4to, 14 pp. Scientific News, No. 3, Vol. I., Munn & Co., New York, $1.50 per annum; Botanical Index, L. B. Case, Richmond, Ind., monthly, 50c. Population and Resources of Alaska; a report of Ivan Petroff, special agent of Census Bureau, Dec., 1880, 8vo, pp. 86. American Kindergarten Magazine, Vol. 3, No. 11, March, 1881, Emily M. Coe, N. Y. monthly, $1 per annum; The Platonist, Vol. 1, No. 1, February, 1881, Thos. M. Johnson, Osceola, Mo., $2 per annum; The Illustrated Cosmos, Chicago, Ill., Vol. 1, No. 2; $1.50.

SCIENTIFIC MISCELLANY.

NOTES AND QUERIES.

The Historical Magazine for April 1861 has an article on Dr. A. Waldo, a surgeon in the Revolutionary war in which occurs the following: "He left numerous writing on professional subjects, illustrated with well executed drawings. * * * * * * * * * These writings are to-day in the State of Missouri, fifty miles beyond St. Louis." Are these writings still preserved, and if so, in whose possession are they. ANTIQUARY.

Can any one give me the origin of the name Chariton? It is the name of one of the largest rivers in the State and one of the most populous counties, but its origin seems to be in doubt. J.

The name of Manuel Lisa or Liza appears frequently in the accounts of expeditions among the Indians of Missouri and up the Missouri river eighty or ninety years ago. From these accounts it would appear he had extensive dealings with the Osage Indians. Are any of his descendants or relatives now living, and if so are they possessed of any of his papers in which mention is made of transactions with the Osages? OSAGE.

Edward G. Mason, in his article on Kaskaskia, published in the Magazine of American History for March, 1881, says: "On the 18th of December, 1727,

died Zebedee Le Jeune Donni, of the Reverend Jesuit Fathers," * * * * * * And in the next paragraph the following: "Among the witnesses who sign are * * * * * * and Zebedee Le Jeune, the priest whose death in 1727 is noted in the burial register." Was there a priest at Kaskaskia of this name or was he a *donne* or given man. His name does not appear in Shea's History of the Catholic Missions in America. ILLINOIS.

Will some student of our early history refer me to the volume where the particulars of the French expedition, which is said by Switzler and other historians of our state to have ascended the Missouri as far as the mouth of the Kansas in 1705, are to be found. W. H.

I am astonished at hearing the noon steam-whistle from Topeka quite often and distinctly here—25 miles away. For the past week their time has been fifteen minutes ahead of our farm time. Are sound waves often so widely distributed? J. S.

Sir Edward Thornton, in his reply, March 11, '81, to a communication from the New York Produce Exchange, says: "That trichina spiralis exists among hogs in the United States, and that some individuals have died from eating pork containing that insect, seems to have been proven." Is trichina spiralis an *insect?* L.

AGASSIZ.

PROF. T. BERRY SMITH—1874.

Oh, why so still, thou great and wondrous man?
Unfold those hands, and ope' those sleeping eyes,
And, breaking silence, speak again to me
About the earth and all that therein is.
They tell me he is dead. But is he dead?
His body's dead, indeed; but what was it
Except the dwelling place of restless mind
Which, all the while it lived within these walls,
Was reaching out and panting to be free?
He is not dead—Agassiz cannot die.
Long years ago his little bark was one
Of a great fleet that sailed along the shores
Which bound life's stormy ocean. Bolder grown
And with a daring heart, he left the throng
And sought the vaster deep. There, far beyond
The lines that marked his chart, fearless he ran;

And, as his prow broke up the ancient deep
And ploughed the unknown sea, the surges rose
Behind the driving wheels and sped away
Toward the far off shores. And yet they speed
And will, till time is over.
Master in Science!
Father of many a thought that, till thy birth,
In Nature's vault had lain, and no one knew
The key to ope'the door. At the command
The ponderous bolts flew back, and gates now first
Unbarred, wide open swung; and while they turned
The view disclosing more, thine eager soul
With lustrous eye peered in and caught the gleam
That shot from many a gem. The briny sea
From out its unseen depths gave up a hoard
Of new and wondrous things, when thy long arm
Beneath the waves reached downward, grasping the fields
That base the nether deep. And ancient earth,
"The mother of all living," gave up her dead—
The long lost tribes that were in primal years
And are not now, nor any semblance bear
To all that live upon this later stage—
Whose bones thou saw'st and all the form restored
Or from a trace drew out the perfect whole.
Agassiz dead? Agassiz cannot die.
'Twas at his wish the unknown sea gave up,
And earth its caverns ope'd that he might gaze
Upon her treasured wealth.
The voiceless past
Once more took up its harp, and smote, and sang;
The thrills that ran across its chords were sweet,
The language long forgot, but echoing hills
Along the shore of time the music caught
And carried to his ears. He listened long
At the exultant strains, and then the words
Proclaimed to all the earth, wishing the tribes
That dwell to-day to be ecstatic too.

THE EARTHQUAKE AT ISCHIA.

The earthquake, which a week ago shook Ischia to its foundations, has desolated an island at once beautiful and historic. At the western entrance of the Bay of Naples, about twenty miles from the mole, the view from its shore is one of the loveliest in the world. The blue sky overhead, reflected in the blue waves

beneath, seems fairer to the traveler than any other spot on earth, and when he has walked nine miles inland and climbed the lofty hill Mount Eponeo, as it is now called, he sees stretching far into the distance the long indented line of the Italian mainland. Procida and other smaller islets are beneath his feet, and pleasure boats and fishing smacks, their white sails lazily flapping in the light breeze, creep out upon the dancing waters from hundreds of villages clustering round the inlets far and near. It is a scene to entrance a poet, but not from its intrinsic beauty only. All the charms of old association are gathered thickly round it. Ulysses himself was there when the dawn of history was but passing into the morning hours, and it has been consecrated by the immortal verses of both Homer and Virgil. In later days Berkely, the most imaginative and sensitive philosopher since the days of Plato, declared that Ischia was an epitome of the whole earth, and the visitor on descending the mount in the center might easily fancy that the golden age had returned and that the flaming sword had once again been removed from the gates of Eden. Grapevines cover the gentle slopes of the many hills, groves of chestnuts and thickets of myrtle crown their tops. Wheat and maize enrich the valleys, and the most exquisite fruit tempts the hand on every side. Apricots, peaches, oranges, limes, pomegranates, figs and melons attest the richness of the soil and the general beneficence of the climate. Nor does languor, as in so many southern lands, step in to clog the full enjoyment of all this wondrous loveliness and luxuriant profusion. Even in the height of summer the delicious and cooling sea breezes pour a constant fountain of new vigor into the frame of the people.

So unrivaled a situation has attracted thousands to Ischia. In the early years of the sixteenth century three celebrated women simultaneously selected it for their temporary home. Joanna, of Naples; Berenice, the widow of the great Matthais Corvinus, and Isabella, the widow of Gian Galeazzo, lived near together, and a quarter of a century afterward Vittoria Colonna, the widow of the hero of Pavia, made it her residence. There she wrote her pathetic poems in honor of the memory of the husband she had lost. Hers was one of the greatest female intellects of the middle ages, and the echoes of her song made Ischia famous throughout Europe. When Ariosto and Michael Angelo spoke or wrote of her and her works, they dwelt also with rapture upon the landscape in the midst of which her genius ripened into such splendid blossom. And as time went on, noble men and beautiful women, and poets and artists of all nations, have delighted to haunt the spot for a while and celebrate it with voice, with pen or with brush. But ever in the background of time, the remembrance of a specter of dread days that had been, never passed away. The island itself was undoubtedly of volcanic origin, and, indeed, during the many years in which Vesuvius slumbered until she again awoke into action amid all the horrors that overwhelmed Pompeii and Herculaneum, it was believed to be a safety valve for the subterranean fires raging beneath in the bowels of the earth. As in other lands parents tell their children tales of fairyland, so in this Ischia, wreathed as it seemed with smiles that could never fade, the folk lore was tinged by never so slight a tint drawn from

the volcanic devastation so far by-gone that to the simple villagers it has ever been included in that mysterious era of "once upon a time" so familiar to the tales of our own childhood. But now the dim tradition has become a sad reality. The earthquake which none can foresee, but in the presence of whose resistless force the boldest tremble, has brought ruin again upon the island; and 3,000 people, but ten days ago so happy in their earthly Paradise, are seeking the bodies of the killed or wandering to and fro homeless in the land.—*Globe-Democrat.*

RAILROAD AND TELEGRAPH LAND GRANTS.

The following is an official statement of public lands which have been granted by Congress to aid in the construction of railroad and telegraph lines:

Gulf and Ship Island Railroad, Mississippi, granted 1856, 652,800 acres.

Alabama and Florida Railroad, Alabama and Florida, granted 1856, 419,520 acres.

Coosa and Tennessee, Alabama, granted 1856, 132,480 acres.

Mobile and Girard, Alabama, granted 1856, 840,880 acres.

Coosa and Chattanooga, Alabama, granted 1856, 150,000 acres.

Alabama and Chattanooga, formerly Northeast and Southwest Alabama and Mills Valley Railroad, Alabama, granted 1856, extended, 1869, 897,920 acres.

Pensacola and Georgia, Florida, granted 1856, 1,568,729 acres.

Florida, Atlantic and Gulf Central, Florida, granted 1856, 183,153 acres.

North Louisiana and Texas, formerly Vicksburg, Shreveport and Texas, Louisiana, granted 1856, 610,880 acres.

New Orleans, Baton Rouge and Vicksburg, Louisiana, granted 1871, 3,800,000 acres.

St. Louis and Iron Mountain, Missouri, granted 1866, 640,000 acres.

Little Rock and Fort Smith, Ark., Arkansas and Missouri, granted 1856, 1,009,296 acres.

Detroit and Milwaukee, Michigan, granted 1856, 355,420 acres.

Houghton and Ontonagon, formerly Marquette and Ontonagon, Michigan, granted 1856, extended 1864 and 1868, 522,575 acres.

North Wisconsin, formerly LaCrosse, Lake Superior and Branch to Bayfield, Wisconsin, granted 1856 and 1864, extended 1864, 1,408,455 acres.

Wisconsin Central, formerly Portage, Winnebago and Superior, Wisconsin, granted 1864, extended 1874, 1,800,000 acres.

St. Paul and Pacific, St. Vincent extension, formerly branch to Red River of the North, Minnesota, granted 1857 and 1865, extended 1873 and 1874, 2,000,000 acres.

St. Paul and Pacific, Brainerd branch, formerly branch to Lake Superior, Minnesota, granted 1862 and 1865, extended 1873 and 1874, 1,475,000 acres.

Hastings and Dakota, Minnesota, granted 1866, 530,000 acres.

Oregon Central, Oregon, granted 1870, 1,200,000 acres.

Atlantic and Pacific, various States, granted 1866, 42,000,000 acres.
Texas Pacific, various States, granted 1868 and 1874, 18,000,000 acres.
Northern Pacific, various States, granted 1864, 47,000,000 acres.

SEPARATING GOLD, SILVER, AND COPPER ALLOY BY ELECTROLYSIS.

Among the later inventions well worthy of the attention of metallurgists, is the electrolytical process of refining, patented by E. André, both in this country and in Europe. This process has not been practically applied in this country, but is said to be in operation at the copper works of Messrs. Mason & Elkington, Pembrey, South Wales; at Birmingham and Manchester, England; the government works at Mahsfeld, Ocker, and Duisburg, Germany, and the refining works at Hamburg and Frankfort-on-the-Main. The results obtained at these works are said to be of the most satisfactory nature, and with the improvements of the dynamo-electro machine, which are continually making, even better results are expected in the future. This process is said to completely extract, more economically than by other means, the precious metals from their base alloys, and separate the latter in a chemically pure metallic form. Mr. André employs the current of the dynamo-electric machine on the material to be separated as anodes suspended in diaphragms in a diluted acid or alkaline bath, according to circumstances. When the disintegration of the alloys occurs, the precious metals are retained in the diaphragms, and the baser metals are deposited in a pure metallic state upon the cathodes placed opposite the anodes. The bath is changed at proper times, to free it from accumulated impurities, such as zinc, iron, antimony, etc. —*Engineering and Mining Journal.*

MISSOURI WATER POWER.

Had Missouri been peopled for the last sixty years by the overflow of population from New England, she would doubtless be a manufacturing prodigy. The motors with which nature has furnished her so lavishly, would by this time have been turned to full account, and would be famous as the agents of an enormous productiveness in a great variety of lines. No eastern State is credited with having such an aggregate volume of available water power as investigation shows Missouri to possess. Yet her labyrinth of rapid dashing streams, and her multitude of perennial springs, have scarcely any reputation away from their own neighborhoods. Probably few Missourians have an adequate conception of the amount of energy which is daily going to waste through the State, in the shape of unused but valuable water power. But only when Missouri is thoroughly canvassed can the possessions of her 113 counties be fully realized.

The southern half of the State is abundantly supplied with large springs; yet

taking the State over, there is seldom a section of land without its overflowing fountain of water. The one called Bryce's spring, on the Niangua river is probably the largest. It discharges 10,927,000 cubic feet per diem, and flows away, a swift stream forty-two yards wide. Its temperature is steady at 60° Fah., and ice never forms near it to impede machinery. Its flow is regular, so that the machinist can know just what power to depend upon the year round. Upon the upper courses of eleven Missouri rivers, most of which are more or less navigable, fine water powers are to be found at intervals of from one or two to five, ten or fifteen miles. True, to make these powers available, the rough descents where they exist would generally need to be supplemented by the usual artificial appliances, such as dams or means of confining the channel to a narrow space; but happily, at these rapids the beds of the streams are invariably rocky, thus affording a sure foundation. Though the average annual rainfall of the State is forty-one inches, springs constitute the reliance of our streams for a steadfast flow of water. Several hundred springs are known to be large and forcible enough to supply the power required to run an ordinary mill or factory.—*The Age of Steel.*

TRICHINÆ IN MAN.

It has been previously stated, that for some thirty years subsequent to the first description of the capsule by Hilton, and some twenty-five years after the identification of the parasite itself in man, the same were looked upon as mere harmless curiosities, and, that, although Leidy discovered the parasite in the flesh of swine in 1847, still it was not until 1860 that the connection was established between them, appearing, as they had, in two totally different species (men and swine). The honor of this important discovery belongs to Dr. Zenker, of Dresden, Germany. The disease was discovered in a servant-girl admitted as a typhus patient to the City Hospital in Dresden. She died, and her flesh was found to be completely infested with trichinæ.

Leuckart's and other experiments have shown that a temperature of 140° F. is necessary to securely render trichinæ inert. Direct heat applied to the slides holding specimens of trichinous pork, by means of the Shultz heating-table, has demonstrated, under the microscope, that a temperature of 50° C. (122° F.) is necessary to the certain death of the trichinæ.

Leisering's experiments with trichinous pork, made up into sausage-meat and cooked twenty minutes, gave positive results when fed to one rabbit, and negative by another. He sums up his experiments as follows:

1. Trichinæ are killed by long-continued salting of infected meat, and also by subjecting the same for twenty-four hours to the action of smoke in a heated chamber.

2. They are not killed by means of *cold* smoking for a period of three days, and it also appears that twenty minutes cooking freshly prepared sausage-meat is sufficient to kill them in all cases.

XUM

The various kinds of cooking, however, are quite different in their effects on trichinous pork. Frying and broiling are most efficient, roasting coming next. Boiling coagulates the albumen on the outer surface, and allows the heat to penetrate less readily; it should be kept up, therefore, for at least two hours for large pieces of meat. Whether boiled, broiled or fried, pork should always be thoroughly cooked.

Practically speaking, the cooking, salting and hot smoking which pork in its various forms receives in the United States, must be in the vast majority of cases sufficient to kill the trichinæ and prevent infection of the persons consuming the meat. Epidemics like those reported in Germany are unknown here, and trichiniasis in a fatal form is undoubtedly a rare disease. In the vicinity of the great pork packing establishments near Boston, the "spare ribs," containing the intercostal muscles, are very largely bought and eaten by the people near by; and trichiniasis among them has not in a single case been reported, so far as I have been able to learn. The *cuts* being thin and well cooked, any trichinæ in them are quite certain to be killed. Even when trichinæ are introduced into the intestinal canals too, they are sometimes expelled by diarrhœa, and the invasion of the system by a small number does no harm.—*American Microscopical Journal.*

That predjudice against "them litery fellers," which in this country identifies statesmanship with ignorance, will be shocked to learn that one of the last performances of the author of Lothair before resigning office was to make Owen Meredith an Earl, under the title of Earl Lytton, of Lytton and Viscount Knebworth. The new fellows who come in are almost all of them literary. Gladstone is a voluminous writer, the Duke of Argyle is as proud of his literary record as he is of being the Macallum-More, Lord Selborne has condescended to edit a hymn book, and a very good hymn book it is, too, Vernon-Harcourt used to write for the *Saturday Review*, Foster has written a life of William Penn, Earl Granville is a man of great linguistic attainments, and, taken altogether, the new Ministry, admittedly one of the strongest in point of statesmanship and political influence that England has known for years, is undoubtedly the strongest in point of literary attainments and in the record of authorship among its members.

SCIENCE IN THE SCHOOLS OF FRANCE.

The modifications in the course of studies in the French public schools, recently decreed by the Superior Council, give to scientific teaching a more prominent place than has hitherto been allowed it, especially in the elementary classes. In the seventh class, the elements of the natural history of animals and plants are added to the history of soils and stones, and take preference over it, as offering more interest to children and being of more practical utility. In the sixth class an hour is deducted from the ten devoted to Latin and added to those given

to the sciences, which are allowed four hours a week. In the fifth class, where scientific instruction has been obviously deficient, the hours for Latin are reduced to five, and the sciences are given four hours. In the fourth class an hour is taken from Greek, and the hours for scientific instruction are increased to four. Scientific instruction will be continued in the third, second, and rhetorical classes without encroaching upon the other courses, an hour being taken from the study-hours for new subjects of natural history in the third class, for physics in the second class, and for subjects of physics which have not been previously entered upon by the pupils, in the rhetorical class. The Superior Council advises that the teaching of mathematics and the natural sciences in the grammar-classes be committed to special professors whenever the funds of the school will permit it and suitable teachers can be obtained; otherwise, professors of science in the higher classes may perform the duty for an additional compensation; or, if there is no other way, the ordinary professor may provisionally give the special instruction.—*Popular Science Monthly*, March, 1881.

CREDIT TO THE U. S. SIGNAL SERVICE.

The violent storm of the last two days, with its destructive gales and floods, naturally invites attention to the present condition of scientific weather wisdom in this country. On Tuesday last we published the following telegram from New York: "A dangerous storm is crossing north of latitude forty-five degrees; will arrive on the British and Norwegian—possibly affecting the north French—coasts between the 27th and 29th, attended by strong south winds, veering to north-west gales, rain and snow in north; low temperature follows. Atlantic very stormy." This time, at least, the forecast has fulfilled itself almost to the letter, only the prophesied storm seems to have traveled across the Atlantic a little quicker than was calculated, for it began on Tuesday afternoon, and seems to have reached its utmost violence some time during the night of Wednesday. From all parts of the country reports reach us of the violence of the wind and the violence of the rain. Off the mouth of the Tyne, and even within its still treacherous harbor, several wrecks have occurred, resulting in a lamentable loss of life. At Falmouth, at the other end of the kingdom, vessels are putting in almost dismantled by the terrible force of the sea. From Edinburg and Southampton, from Brighton and Liverpool, similar accounts are sent, while in the interior continuous rainfall is producing disastrous floods in all directions. At Wenlock, in Shropshire, the line of railway has been bodily washed away, and all traffic is suspended, while the gas supply of the town is cut off by an inundation which has invaded the gas works. Retford is threatened with the same fate. At Walsall, water lies seven or eight feet deep at the railway station, and the traffic of the trains is stopped. Leeds is buried in snow and Leicester is overwhelmed with floods, while all over the Midlands water covers the meadows, and in some places the housetops are concealed beneath the floods. It is almost unnecessary to say that

in such circumstances Oxford lies, like Venice, in the midst of a vast lagoon. The phenomenon is so familiar as hardly to excite comment, still less indignation, although it is perfectly well known that the perpetual inundations of the Upper Thames Valley are largely due to causes which, if not removable, are susceptible of very considerable control. The effect of over thirty-six hours' heavy and almost continuous rain is felt, however, in all parts of the country, almost as much as in the over-burdened Thames Valley. Certainly the American forecast seems in this case to have been very abundantly justified. The coincidence is at least remarkable enough to make a deep impression on the popular mind and imagination, even if professed meteorologists should see reason to doubt whether there is any direct connection between the storm which left the American continent on Monday and the gale and deluge which burst with such violence over our own islands before the end of Tuesday.—*London Times, October 20.*

A PROJECT FOR THE YEAR 2000.

Lake Mackenzie is one of those "possibilities of North America" recently suggested. The lake would result from a proposed closing of the northerly outlet of the valley of the Mackenzie River, at the line 68° north, and storing up the water of 1,260,000 square miles. And to this could be added the water of other large areas. It would be a lake of about 2,000 miles in length by about 200 of average width. Its surface would have an altitude of about 650 feet above sea level. It would cover with one continuous surface the labyrinth of streams and lakes which now occupy the Mackenzie Valley. It would be a never failing feeder for the Mississippi. It would connect with Hudson Bay and with the "great lakes," and also with the interior of Alaska by connecting with the Yukon and its affluents. By concurrent results and other "possibilities" it would become, during some months of each year, a navigable water, adding not less than 12,000 miles of communication to the Mississippi. It would complete the interior lines of river courses by connecting them. Cutting the "divide" which now exists between the Mississippi and Mackenzie would do this. The work is small when measured by its results, and it becomes easy of accomplishment under the methods proposed. The connecting of the Upper Mississippi with the proposed Lake Mackenzie would be easily made if that lake had a surface at the proposed altitude of 650 feet above the sea. The outflow from such a lake, having a length of more than 2,000 miles from south to north, and draining a very wide range of altitudes and latitudes, would be a timely and enduring one. This lake would make possible and easy the straightening of the Lower Mississippi. It would also contribute to the proposed ship channel from Cairo, Ill., to the Gulf of St. Lawrence, by the almost straight line which cuts the Wabash Valley, the Lakes Erie and Ontario, and the Lower St. Lawrence. This commercial channel, receiving all the waters converging at Cairo, would complete the demand for a constantly open ship cannel from the St. Lawrence to the

sea by way of the Strait of Belle Isle. That demand can be complied with, and the shortest and best line of communication can be thus opened between the interior and the seaboard.—*St. Louis Republican.*

SMOKELESS FUEL FROM COAL.

Mr. W. D. Scott-Moncrieff, in a paper read before the Society of Arts, has recently brought to the attention of that body an important project for not only hereafter preventing, but also for rendering commercially available the dense stratum of smoke that has so long hung like a pall over the city of London, obscuring the light and rendering the atmosphere dangerous to the whole community. He proposes to substitute for the bituminous coal now in universal use for domestic and industrial purposes a modified form of this coal from which the gas has been partially extracted. Experiments made by him as long as ten years ago showed that a semi-coke, resulting from a short distillation of coal, furnishes a fuel that is practically smokeless; and he has since discovered that, treating this coke with water when hot, renders it still more smokeless and makes it the most perfect fuel imaginable, as it has all the cheerfulness and heat-giving properties of the unprepared coal, with none of the disadvantages arising from its use. To produce this fuel in quantities suitable for public use he proposes to take advantage of the existing plant of the gas companies, finding that they are amply sufficient for the purpose. Instead of taking 10,000 cubic feet of gas per ton from the coal, he would take 3,333 cubic feet, or any other convenient proportion, and pass three times the quantity through the retorts. In this manner the gas would be coming away from the retorts all day long, just as formerly, with a slight loss of time to be allowed for the additional frequency of the charging. The supply at the end of the twenty-four hours would be in excess of that which is obtained from the long extraction, and in this way less and not more plant would be necessary to give the same quantity in a given time while the gas itself would be of better quality. The author claims, from his investigations and experiments, that the results of the application of his scheme would prove startling. The gas companies would have double the quantity of by-products, in the shape of tar and ammoniacal products, that they have at present; the community would have twenty-four candle instead of sixteen candle gas; the fuel resulting from the process would be of a nature to ignite readily, make a cheerful fire that gives out twenty per cent. more heat than common coal; and London would become a smokeless city. The only extra expense to the companies would be that of the additional workmen employed in charging the retorts and interest upon the additional capital required for transit appliances; but, as an offset, the the companies would receive an increased quantity of valuable by-products and a supply of fuel that would be in universal demand; and the profits from the sale of this at prices much below that of coal would be such that the companies would be actually getting their coal for nothing.—*Age of Steel.*

XUM

LIFE WITHIN THE ARCTIC CIRCLE.

The following extracts from the narative of Mr. Leigh Smith's voyage to Franz Joseph Land last season (1880) show the abundance of animal and vegetable life, as far north as it has been possible for vessels to reach in that direction:

* * * * * * * * *

May Island, Long. 53° 40′ E., Lat. 80° N., Aug. 14, 1880:

Several walruses were seen on some ice to the eastward, and Mr. Leigh Smith, with Captain Lofley and the Doctor went in chase, while Mr Grant and the Shetlander, Peter, landed and climbed to the summit of the island, a height of some 200 feet. It proved to be a mass of basalt. The scene was desolate, but very grand. Below them lay the ship anchored to the floe, and far away in the distance the walrus boats could be seen. To the north was the coast of land to the west of McClintock Island, sinced named after Sir Joseph Hooker, enveloped in mist, with loose ice floating through the intervening strait. It was calm, and all was still until the silence was broken by the ivory gulls (*Pagophila eburnea*) which Peter had disturbed on their nests. Seven of them were taken alive, of which one survives, and is now in the Zoological Gardens. They had built near the top of a low basaltic cliff, and the young ones were tilted out of their nest on the snow beneath. On this island there was a quantity of drift-wood, and one very large stem of a tree. During the day seventeen walruses were captured, and many more might easily have been taken.

* * * * * * * * *

Eira Harbor, 80° 4′ N. Lat., 48° 40′ E. Long., August 20, 1880.

In the morning of the 20th three bears were seen on the shore, a mother and two cubs, slowly wandering about and sniffling the sand. An empty box had been left on shore, and they were seen walking round and examining it. They did not seem to take any notice of the ship. The plan of attack was soon arranged. Two boats were lowered, one remaining to the left of the bears a little off shore, while the other rowed away to land the attacking party at some distance. After landing, the assailants walked towards the bears, and, as their backs were turned, they easily got pretty close. As soon, however, as they saw their enemies, all three bears made a rush to the water. This sealed their fate. They were doomed, the mother to death, and her two children to an aimless life of inactivity at the Zoological Gardens. The two boats closed in; a shot through the head ended the life of the mother and saved her from witnessing the degrading spectacle which followed. The men made quick work of the affair. The boats closed in with the young bears between them, and in very short time each boat had a bear to tow it back to the ship.

* * * * * * * * *

Lat. 80° N., Long. 52° E, Aug. 21.

In returning, an attempt was made to secure a young walrus alive. But the mother fought frantically, and guarded her offspring with such resolution that they were obliged to kill her, when the young one immediately decamped. Di-

rectly the mother is shot dead, the baby walrus always hurries away, but so long as the mother is alive, even if wounded, the young one remains by her. In this case there was a hard fight, and the boat reached the ship in a sinking condition, the walrus having made holes in it with her tusks, below the water line.

After this little episode, the *Eira* was steered westward along the coast, towards the most distant point seen from the harbour. But she was stopped by packed ice at a point where there were great numbers of loons.

* * * * * * * * *

Mr. Grant walked along the shore to the eastward until finally stopped by a glacier. There was a regular beach, and a good deal of drift-wood, including a spar 8 feet long, which had evidently belonged to some ship. There were also the backbones and jaws of two whales. In the evening a party accompanied Mr. Grant to the summit of the hill overhanging the harbour, which proved to be 1040 feet above the sea (by aneroid). On the slope of this hill a good deal of petrified wood was collected, and some other fossils.

* * * * * * * * *

Lat, 80° N., Long. 50° E., Guenther Bay.

On the 26th and 27th a furious gale was blowing brom the N.N.W. with much snow; and on the 28th, when it was still strong, but moderating, they steamed slowly eastward along the coast. In passing out of the bay, two right whales were seen, one of great size.

Commenting upon the results of Mr. Smith's voyage, Mr. Northam, in the March "Proceedings of the Royal Geographical Society," says:

Arctic exploration is distinguished not only for the variety and importance of its scientific results, but also for its practical utility. It has not only added to the sum of human knowledge, but it has also increased the wealth of those nations which have wisely engaged in it. The explorers of Hudson's Bay led the way to a lucrative fur trade; those of Spitzbergen, of Davis Strait, and Baffin's Bay opened up other great sources of wealth; and the discoverers of New Siberia enriched their countrymen by a trade in fossil ivory. Mr. Leigh Smith, in discovering the south-western coast of Franz-Josef Land, saw at least two right whales, and a sea abounding in other oil-yielding animals. As many as twenty-seven walruses were taken, and, if their capture had been the object of the voyage, many more could have been obtained. Great numbers of seals were also seen. The number of bears shot was thirteen. Like all other northern discoveries, those of Mr Leigh Smity combine results of scientific interest and importance with practical utility.

It is not at all unlikely that the practical utility of Mr. Leigh Smith's discoveries may be demonstrated in the near future. The Norwegians have now been frequenting the walrus grounds of Spitzbergen and Novaya Zemlya for a considerable number of years, and there are distinct signs of those localities having been overworked. The hardy Norseman will eagerly welcome a new region for walrus hunting, such as is offered by the southern shores of Franz-Josef

XUM

Land; and even whalers may not improbably follow in the same direction. The only difficulty which may cause them to hesitate is the supposed obstruction of the approach, by ice floes. Explorers, by annual reconnaissances, will throw a flood of light on that question, and, as in so many other instances, Arctic discovery will prove to be not only important in increasing the sum of human knowledge, but also in opening up new sources of commercial industry.

The following letter of Gen. Washington is in possession of a gentleman living at Mendon, Chariton Co., Missouri:

MOUNT VERNON, April 22, 1789.

SIR:—I received this day by the Free Mason, Capt. Lawrence Layton, four tierces and three barrels of seed which were notified by a letter you were so obliging as to forward by last stage. I beg leave in behalf of my Uncle to offer many thanks for your care of and dispatch in forwarding them—as the freight agreed upon was not specified and the Captain informed me that you would settle it, will thank you by the first stage to inform me the amount and any other charges that may have arisen from its transportation and the money shall be immediately remitted to you.

I am Sir, Your Obedient Humble Servant,

GEORGE WASHINGTON.

RICHARD CURRAN, ESQ.

THE FIRST REGULAR MEETING OF THE NEW MEXICO SOCIETY.

At the first regular meeting of the New Mexico Historical Society, composed of the most influential and prominent officials and citizens, the president, Acting-Governor W. G. Ritch, made an able and exhaustive address, reviewing the objects of the society, outlining the ancient history of the territory and calling special attention to the three-century-old palace dating from the earliest existence of the Spanish colonists in New Mexico. He recommended, and a memorial is being prepared and extensively signed praying Congress for a charter, and asking that this ancient historical relic, the oldest in the United States, be granted to the society for preservation in the interest of the whole country, the society being national in its scope and embracing the oldest and most prolific fields of historical research.

EDITORIAL NOTES.

THE present number completes the fourth volume of the *Review*, and we again express our sense of obligation to our subscribers, and especially those in this city, for their generous sympathy and support. To the liberality of the latter class we attribute the unusual success that has attended our efforts to build up a magazine which should be a credit to the people of the West and a suitable medium for disseminating their theories, discoveries and inventions. Of course the fact that such a journal thrives in any community is a guaranty to the world that the taste and enterprise of that community are of a high order and has its full weight in attracting persons of similar tastes and spirit to make it their home and field of labor.

The fifth volume begins with the May number and we hope to receive enough additional subscribers to place the *Review* on an independent basis, pledging ourselves to improve it in every respect at a rate commensurate with its patronage.

As heretofore, we will bind the volume just closed in good, handsome binding, half morocco with cloth sides, for one dollar. All subscribers desiring this or any of the preceding volumes bound, will please send in their back numbers as soon as possible, either to this office or to the counting-room of Ramsey, Millett & Hudson.

Missing numbers of the third and fourth volumes supplied at current rates. Those for the first and second volume supplied gratis, or full sets at $1.25 per volume unbound, or $2.25 bound.

On the 29th ult. occurred the March meeting of the Kansas City Academy of Science. The feature of the evening was a second paper on "The Future Drainage of Kansas City," by Mr. Robert Gillham. In his first paper Mr. Gillham pointed out the mistakes made in early sewerage in London, Boston, New York and Chicago, which, having increased the death-rate by not meeting the sanitary conditions, were subsequently rectified, entailing a heavy loss on those cities. In his second paper he proposed a system of drainage for Kansas City which he claims will meet the necessities of the city, however large its population may become. Mr. Gillham's system proposes radical modifications of the present plan.

The Academy voted to publish the papers in pamphlet form, for the thoughtful consideration of the people of Kansas City.

The secretary called attention to the recent exploration of the Beni river, in South America, by Dr. E. R. Heath. He said these discoveries would be recognized by Geographical Societies everywhere, and modify all our maps of that country.

WE are requested by Mr. Sidney Hare, curator of the Kansas City Academy of Science, to inform all persons who have geological, mineralogical, archæological or any other specimens of value or interest to donate to its museum, that he will promptly respond to a notice of any kind and call for them. He will put them in order, label them, and place them in secure cabinets, where they can be seen by the public, but preserved carefully.

THE project of the removal of the Morrison Observatory from Glasgow to this city meets with more favor than was expected when the suggestion was made by Dr. Lewis, who is a relative of Miss Morrison, the donor of the funds with which the Observatory was built and equipped. There are several wealthy gentlemen here whose education and inclinations would prompt them to contribute liberally to such a purpose, were it found to be feasible. Twenty-five thousand dollars is estimated to be ample for the carrying out of the scheme; an

amount that could be raised in one day if necessary, and we should then have an institution which would be an honor to the city, as the work of its astronomers is now a credit to the West. As one of the departments of a University to be built up here it would have a world-wide reputation to start with.

IN common with many other scientific magazines of the country, we shall hereafter devote a portion of our space to "Notes and Queries," to which department we invite contributions on all appropriate subjects by our subscribers and interested readers.

A RECENT visit to Washington University, at St. Louis, and a careful inspection of its ample, complete and modern buildings, apparatus, and appliances for illustrating and teaching, not only the ordinary branches of education, but natural philosophy, chemistry, technology, painting and sculpturing, convinced us that in many of these departments it is not equaled in the West, and that it is excelled in none. In the departments of physics and practical engineering it is especially strong, the students being put to the actual work of doing with their own hands the experimenting with fluids, solids, metals, etc., the architectual drawing, the construction of models in wood for castings, the forging of tools, etc., which he expects later in life to use and to deal with. Everything is practical, even in the art department and the geological cabinet. If even the people of St. Louis themselves generally know what a valuable Institution they have in their midst, which is doubtful, it is far more than the people of the State do, much as they need such an one for the education of experts to aid in developing the inestimable wealth of its mines and its immense natural resources of every kind.

WE are informed that Mr. Chas. Sternberg, of Ellsworth, with a son of Dr. Reynolds, of Riley, as assistant and a driver, are collecting Kansas fossils for Prof. Agassiz, of Harvard College, Mass. They started March 1st and are now collecting among the fossil leaf impressions of the Dacotah group, a division of our Cretaceous. They work first in Western Kansas, and, if time allows, they will this fall collect a full set of coal fossils, also.

WORK upon the tunnel under the Hudson river, connecting the cities of New York and Jersey City, is being pushed forward at the rate of about five feet a day. A small tunnel six feet in diameter is run ahead of the larger one, which follows and incloses it. Warning is thus given of the nature of the soil.

A DISTANT subscriber to the REVIEW in a private letter writes as follows concerning Col. Van Horn's article in the February number: "I have been waiting for years for some one to utilize Prof. Crook's radiant light, and has not Mr. Van Horn done it well in his "New Hypothesis? I can follow him with deep interest through the larger portion of the article, but once in a while he dives so deep that I have to leave him in the depths. I am almost tempted to visit Kansas City to see him and get more light."

MR. EMIL POURADE has discovered what he believes to be a quarry of very fine lithographic stone, on the Big Blue, about five miles east of this city.

REV. DR. BELL gives the following complimentary notice of the REVIEW in a late number of the *Mid-Continent:* "The articles are numerous and exceedingly well written and chosen. The article by our President of the Academy of Science, Hon. R. T. Van Horn, which leads the whole list, is one of rare merit. The way to make this work a still greater success in all directions, is to buy it, subscribe for it."

AT the close of the ceremonies attending the formal presentation of the obelisk to the City of New York, Algernon S. Sullivan, Esq., on behalf of the American Numismatic and Archæological Society, formally presented to Lieutenant-Commander Gorringe a medal, which the Society had caused

to be struck in commemoration of the event. The medal bore the following inscription: "Presented to the United States by Ismail, Khedive of Egypt, 1881. Quarried at Syene and erected at Heliopolis by Thothmes III. Re-erected at Alexandria under Augustus. Removed to New York through the liberality of W. H. Vanderbilt, by the skill of Lieutenant-Commander H. H. Gorringe, U. S. N."

FOR the first time in the history of the Franklin Institute a woman has delivered a course of lectures there. Professor Rachel Bodley, of the Women's Medical College of Pennsylvania, was the lecturer, and she gave a course of six lectures on "Chemistry, as applied in the household." They were largely attended.

THE Kansas City REVIEW OF SCIENCE AND INDUSTRY, edited by Theo. S. Case, presents an extensive array of general scientific information, clearly and concisely put, the most recent developments and latest movements in that line of progress upon which we base great hopes for the future. It is now running upon the fourth volume, and may be said to be an established institution. —*Boston Post.*

The great event of the year in this section was the completion of the second trans-continental line to the Pacific by the connecting of the Atchison, Topeka & Santa Fe Railroad and the Southern Pacific Railroad at Tucson. On the 17th of March the first through passenger train for California, by this route, left the Kansas City Union Depot.

PROF. CLARENCE KING has resigned the position of Chief of the U. S. Geological Survey, and the president has appointed as his successor, Major S. W. Powell, the well known explorer of the western mountains, the Colorado river, etc.

PROF. JNO. D. PARKER, of this city, has recently invented and patented a gauge for the accurate setting of compositors' sticks to different "ems," which will prove a useful and convenient aid to printers in preserving that uniformity in the width of columns which is indispensable to the proper locking up of forms. It is a simple and cheap device which every printer should have.

WE take pride anticipating all other journals in announcing the valuable discoveries recently made by Dr Heath in South America. The exploration of the Beni river has hitherto defied all effort, but Dr. Heath has accomplished this result, so long desired, unaided. He will hereafter be counted among the noted explorers of South America. His brief letter in another column will prove of general interest.

ITEMS FROM THE PERIODICALS.

The New York *Tribune* says: "The ravages of a parasitic insect on orange and lemon trees are attracting much attention in Italy and the West Indies, and have begun to create alarm in Florida, Louisiana and California. J. H. Bostwick, Inspector of Customs, who has charge of the Fruit Department of the New York Custom House, is taking great interest in the matter, and has some specimens from cargoes of oranges, the rinds of which are covered with incrustations of these parasites."

Since observing the above, we have been shown by Mr. John H. Ramsey of this city, an orange with an incrustation answering to the above description. The general shape of these parasites is similar to the *Hemipronites Crassus* and its dimensions about three lines in length and one line in diameter at the larger end.

THE *Journal of the Franklin Institute*, for March, comes to us with a supplement equivalent to sixty pages, being the plates to S. Dudley's artitle on "The Wearing Power of Steel Rails, in Relation to their Chemical Composition and Physical Properties." The article is the result of long study and the illustrations are very interesting and curious.

THE result of the census of 1880 shows the center of population of the United States to

be within the city limits of Cincinnati, Ohio.

Good Company, for February, 1881, presents its readers, among much other entertaining matter, the first chapter of an account of Polar Expeditions, by Lieut. Schwatka, under the title of "In the Land of the Midnight Sun."

THE *United States Gazette*, Philadelphia, of November 27, 1832, contained the following notice: "The locomotive ('Old Ironsides') built by Mr. Baldwin, of this city, will depart daily *when the weather is fair*, with a train of passengers. On rainy days horses will be attached."

OF the various college periodicals we find find none handsomely printed, better edited or more entertainingly contributed to than the *Olio*, of Marietta College, Ohio. Its *Personalia* are especially interesting to the *alumni* of the institution. It is now in its ninth volume. Monthly, $1.50.

THE *Nationalist*, of Manhattan, Kansas, sends us a handsome pamphlet, entitled "The Blue Ribbon County," being a full and careful description of Riley county, its people, educational advantages, natural resources, products, etc., which immigrants looking westward might procure and profitably read, as we believe that it contains nothing but facts, and very attractive ones, too.

MR. HENRY B. DAWSON, editor of the *Historical Magazine*, of New York, desires copies of reports, papers, tracts, etc., relating to the geology and natural history, geography and topography, aboriginal history and languages, and the antiquities of America, or anything that will throw light upon any of them. The *Historical Magazine* stands very high among periodicals of its class and the material furnished its editor on this call will be carefully and properly handled and used.

VALUABLE BOOKS

On Electricity and Electric Light.

Sawyer's Electric Lighting by Incandescence. 8vo	$2.50
Gordon's Electricity and Magnetism. 2 vols., 8vo.	7.00
Pope's Modern Practice of the Electric Telegraph.	2.00
Higg's Electric Light in its practical Application, 8vo.	3.50
Sprague's Electric Lighting.	.40
Prescott's Electricity and the Electric Telegraph	5.00
Prescott's Speaking Telephone and Electric Light	4.00
(These two books of Prescott sold together for $7.00.)	
Sprague's Theory and Application of Electricity	3.00
Noad's Text Book of Electricity	4.00
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Clark and Sabine's Electrical Tables and Formula	5.00
The Telephone, the Microphone and the Phonograph By Count du Moncel	1.25
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Sabine's History and Progress of the Electric Telegraph	1.25
Jenkin's Electricity and Magnetsim	1.50
Loring's Hand-Book of the Telegraph, bds., 50c.; cloth, 75c.; mor.,	1.00
Haskin's Galvanometer, and its Uses. New Edition, in Press	
Gordon's Lectures on Electric Induction	.80
Fontaine's Eclairage a l'Electricitie	3.00
Urquhart's Electric Light	3.00
Hospitalier—Les Principales Applications de l'Electricite—with many Illustrations, 8vo., paper. Paris, '81.	4.00
Schwendler's Instructions for Testing Telegraph Lines, 2 vols., 8vo	8.00
Jenkin's Reports of Electrical Standards, 8vo	3.75
Cavendish's Electrical Researches, 8vo	5.60
Harris' Treatise on Frictional Electricity, 8vo.	7.00
Beechy Electro-Telegraphy, 18mo	.60
Douglas' Manual of Telegraph Construction	6.00
L'Electricite, par I. Baille	.90
L'Eclairage Electrique, par Du Moncel	.90
Tyndall's Lessons in Electricity, 12mo	1.00
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